

Estate of George v. Vermont League of Cities and Towns (2008-374)

2010 VT 1

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2010 VT 1

No. 2008-374

Estate of Albert George

v.

Vermont League of Cities and Towns

Matthew I. Katz, J.

Joseph C. Galanes of Biggam, Fox & Skinner, Montpelier, for Plaintiff-Appellant.

John T. Leddy and Kevin J. Coyle of McNeil, Leddy & Sheahan, P.C., Burlington, for

Supreme Court

On Appeal from
Chittenden Superior Court

March Term, 2009

Defendant-Appellee.

PRESENT: Reiber, C.J., Dooley, Johnson, Skoglund and Burgess, JJ.

¶ 1. **SKOGLUND, J.** Claimant appeals from the superior court’s order granting summary judgment to insurer in this workers’ compensation case.[\[1\]](#) He argues that the court: (1) exceeded its jurisdiction under 21 V.S.A. § 671 by granting summary judgment to insurer; and (2) abused its discretion by excluding the expert testimony that he offered. We affirm the trial court’s decision.

¶ 2. The trial court found the following facts to be undisputed. Claimant worked for the City of Burlington Fire Department for thirty-six years, first as a firefighter and later as assistant chief. It is not clear if claimant was actively fighting fires throughout his career or if, at some point, he engaged in a combination of administrative work and active duty.

¶ 3. In 2003, claimant died of non-Hodgkin’s lymphoma (NHL). His estate brought a workers’ compensation action, alleging that his work as a firefighter caused him to develop NHL. The Vermont Department of Labor denied his claim. The Commissioner ruled that although claimant proved that there was an “association” between NHL and firefighting, he failed to establish a “causal connection” between the general activity of firefighting and NHL. The Commissioner found no evidence as to the number of fires that claimant fought, the level of his participation in those fires, or the number of such fires that were industrial or commercial in nature, where known carcinogens might have been present. There was similarly no evidence as to the frequency of exposure or types of exposures that claimant may have had. Without this information, the Commissioner found that NHL was possibly, but not probably, related to his employment. The Commissioner thus concluded that claimant failed to meet his burden of proof and she denied the claim.

¶ 4. Claimant appealed this decision to the superior court, and the Commissioner certified the following question for determination: was claimant’s NHL causally related to his work as a firefighter? In August 2007, insurer moved for summary judgment on this question. It asserted that the opinions of claimant’s experts should be excluded under Vermont Rule of Evidence 702 as both irrelevant and scientifically unreliable, and that without any admissible evidence of causation, claimant was not entitled to workers’ compensation benefits.

¶ 5. Claimant responded by moving to strike the motion for summary judgment. He argued that the standard for the admissibility of expert testimony under Rule 702, delineated in Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993), and adopted by this Court in State v.

Brooks, 162 Vt. 26, 643 A.2d 226 (1993), did not apply to workers' compensation claims being tried in superior court. He maintained that the trial court was instead bound by the approach taken by the Commissioner, and therefore it was obligated to evaluate the admissibility of the expert testimony using a "plausibility" standard rather than the test set forth in Daubert.^[2] Claimant also argued that insurer had waived its right to challenge the admissibility of the evidence by failing to raise this argument before the Commissioner. Finally, claimant asserted that the court lacked jurisdiction to grant a motion for summary judgment.

¶ 6. The trial court denied claimant's motion to strike in a written order. It explained that the rules of evidence applied "to all actions and proceedings in the courts of this state," V.R.E. 1101(a), and that it had no discretion to create a new standard for the admission of expert testimony in workers' compensation cases. It noted, moreover, that there was nothing in the workers' compensation statutes that would alter the application of the rules of evidence in such cases. As to claimant's remaining arguments, the court indicated that its review of the Commissioner's decision was de novo, and thus, insurer's failure to raise the Daubert issue below was irrelevant. The court did not directly address the jurisdictional argument.

¶ 7. The court allowed claimant additional time to respond to the merits of the summary judgment motion, and following a hearing, it granted summary judgment to insurer. As discussed in additional detail below, the court found that the expert testimony proffered by claimant did not meet the requirements of Rule 702, and that it was therefore inadmissible. This appeal followed.

¶ 8. We begin with claimant's procedural arguments. Claimant asserts that insurer could not challenge the admissibility of his expert evidence in the trial court proceedings because (1) it failed to raise this argument before the Commissioner; (2) collateral estoppel precluded the relitigation of this issue; and (3) there was no certified question concerning the admissibility of this evidence. Claimant reiterates his position that the trial court should not have applied the rules of evidence, but rather, that it was obligated to apply the same standard as that employed by the Commissioner. Finally, claimant maintains that the trial court lacked jurisdiction to grant insurer's motion for summary judgment because its jurisdiction is limited to answering questions of fact or mixed questions of fact and law.

¶ 9. Claimant appears to misunderstand the nature of the review conducted by the trial court. The court's review of the Commissioner's decision "involves a retrial de novo." Farris v. Bryant Grinder Corp./Wausau Ins. Co., 2005 VT 5, ¶ 10, 177 Vt. 456, 869 A.2d 131 (quotation omitted). That means, as the trial court found, that insurer is not limited to the arguments raised below, and preservation—or lack thereof—is not at issue.^[3] The doctrine of collateral estoppel is similarly not relevant here because there has not yet been a final judgment on the merits. Cf. Sheehan v. Dep't of Employment & Training, 169 Vt. 304, 308, 733 A.2d 88, 91 (1991) (doctrine of collateral estoppel "bars the subsequent relitigation of an issue which was actually litigated and decided in a prior case between the parties resulting in a final judgment on the merits, where that issue was necessary to the resolution of the action" (quotation omitted)).

¶ 10. It is true, as claimant asserts, that the trial court's jurisdiction in workers' compensation proceedings is limited to a review of questions of fact or questions of fact and law certified to it

by the commissioner. 21 V.S.A. § 671; Roethke v. Jake's Original Bar & Grill, 172 Vt. 555, 556, 772 A.2d 492, 493 (2001) (mem.). The question certified in this case was one of fact—did claimant's employment cause his NHL? In the proceedings before the trial court, claimant bore the burden of producing sufficient evidence to support his claim that this question should be answered in the affirmative, and that he was therefore entitled to workers' compensation benefits. See, e.g., Goodwin v. Fairbanks Morse & Co., 123 Vt. 161, 166, 184 A.2d 220, 223 (1962) (“[T]he burden is on the claimant to establish the facts essential to the right asserted.”).

¶ 11. In evaluating this case, the trial court was obligated to apply the rules of evidence and to determine if the expert testimony proffered by claimant was relevant and admissible. See V.R.E. 1101(a) (rules of evidence apply “to all actions and proceedings in the courts of this state”); V.R.E. 104(a) (preliminary questions concerning admissibility of evidence shall be determined by trial court); V.R.E. 402 (evidence that is not relevant is not admissible); 985 Assocs., Ltd. v. Daewoo Elecs. Am., Inc., 2008 VT 14, ¶ 6, 183 Vt. 208, 945 A.2d 381 (trial judges must “act as gatekeepers who screen expert testimony ensuring that it is reliable and helpful to the issue at hand before the jury hears it” (quotation omitted)); cf. 21 V.S.A. § 602 (all processes and procedures under provisions of Title 21, chapter 9, shall be as summary and simple as reasonable may be); *id.* § 604 (Commissioner of Labor not bound by common law or statutory rules of evidence or by technical or formal rules of procedure except as provided in Title 21, chapter 9, and he or she may conduct hearing or trial in such manner as to ascertain substantial rights of parties). The trial court was similarly obligated to apply the rules of civil procedure, including Vermont Rule of Civil Procedure 56. See V.R.C.P. 1 (rules of civil procedure govern procedure in trial courts in all suits of a civil nature, including appeals to the trial court from any department of the state or any political subdivision thereof). Contrary to claimant's assertion, the court did not need certified questions from the Commissioner to enable it to apply the rules of evidence and civil procedure.

¶ 12. We reject claimant's suggestion that these rules are somehow inapplicable in workers' compensation cases heard by the superior court. Claimant cites Crosby v. City of Burlington, 176 Vt. 239, 249-50, 844 A.2d 722, 729-30 (2003), as support for his assertion that the Commissioner's interpretation of Vermont workers' compensation law is controlling absent compelling indication of error. We are not addressing the Commissioner's interpretation of workers' compensation law here, however; we are considering the applicability of the rules of evidence and civil procedure to proceedings conducted in a trial court. The Commissioner has no expertise in such matters, and no deference to the Commissioner's approach is required. Cf. In re Tariff Filing of Cent. Vt. Pub. Serv. Corp., 172 Vt. 14, 19-20, 769 A.2d 668, 673 (2001) (affording no deference to Public Service Board's decisions on claim preclusion and issue preclusion because application of judicially-created doctrines not within Board's areas of expertise); In re Duncan, 155 Vt. 402, 408, 584 A.2d 1140, 1144 (1990) (absent compelling indication of error, interpretation of statute by administrative body responsible for its execution will be sustained on appeal).

¶ 13. The fact that insurer was granted judgment as a matter of law in this case does not transform the certified question into one of pure law that must be decided only by this Court. The trial court's inquiry under Rule 702 was plainly fact-based. And the court merely recognized, following its evidentiary rulings, that claimant failed to identify a triable issue of

fact, and therefore a trial was unnecessary. See, e.g., Sykas v. Kearns, 135 Vt. 610, 612, 383 A.2d 621, 623 (1978) (function of summary judgment is to avoid a useless trial). As we have explained, “when a party fails, after adequate discovery, to make a showing sufficient to establish an element essential to her case and on which she has the burden of proof, summary judgment is required.” Edson v. Barre Supervisory Union # 61, 2007 VT 62, ¶ 8, 182 Vt. 157, 933 A.2d 200. Claimant’s procedural claims are without merit.

¶ 14. We thus turn to the heart of claimant’s appeal—whether the trial court erred in concluding that the expert testimony he offered was inadmissible under Rule 702, and that insurer was therefore entitled to summary judgment in its favor. Rule 702 provides that:

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert . . . may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

This rule is intended to create “a flexible standard requiring only that expert testimony be both relevant and reliable to be admissible.” Daewoo, 2008 VT 14, ¶ 6. We review the trial court’s decision to admit or exclude expert testimony for abuse of discretion. Id. ¶ 9. As discussed below, we find no abuse of discretion here.

¶ 15. In reaching our conclusion, we emphasize several fundamental principles. As the United States Supreme Court has recognized, an expert’s “conclusions and methodology are not entirely distinct from one another.” Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997). Thus, in fulfilling its gatekeeper role, the trial court must “examine the expert’s conclusions in order to determine whether they could reliably flow from the facts known to the expert and the methodology used.” Magistrini v. One Hour Martinizing Dry Cleaning, 180 F. Supp. 2d 584, 595 (D.N.J. 2002) (quotation omitted). Where an expert opinion rests “on nebulous methodology,” it is “unhelpful to the trier of fact, [and] it has no place in courts of law.” Valentine v. Conrad, 2006-Ohio-3561, ¶ 18, 850 N.E.2d 683.

¶ 16. We have held that “the trial court’s inquiry into expert testimony should primarily focus on excluding ‘junk science’—because of its potential to confuse or mislead the trier of fact—rather than serving as a preliminary inquiry into the merits of the case.” Daewoo, 2008 VT 14, ¶ 10. Thus, we have explained that as long as scientific evidence “has a sound factual and methodological basis and is relevant to the issues at hand, it is within the purview of the trier of fact to assess its credibility and determine the weight to be assigned to it.” Id. ¶ 16. At the same time, we are mindful that nothing requires the trial court “to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert,” and the court may properly “conclude that there is simply too great an analytical gap between the data and the opinion proffered.” Joiner, 522 U.S. at 146; see also Daubert, 509 U.S. at 590 (“[I]n order to qualify as ‘scientific knowledge,’ an inference or assertion must be derived by the scientific method.”).

¶ 17. In this case, claimant relied on the testimony of three experts—Dr. Tee Guidotti, Dr. James Lockey, and Dr. Grace LeMasters—to prove that his NHL was causally related to his employment.^[4] Dr. Guidotti opined that, “within reasonable medical certainty and given the weight of evidence,” claimant’s NHL “arose from his work as a firefighter and was caused by exposures in the course of his occupation as a firefighter.” Dr. Lockey asserted that there was “a reasonable medical probability that [claimant’s] work as a firefighter was the cause of his non-Hodgkin’s lymphoma.” Dr. LeMasters had no opinion as to the specific cause of claimant’s NHL. All three experts relied upon epidemiological studies as the basis for their conclusions.^[5]

¶ 18. Epidemiology “studies the incidence, distribution and etiology of disease in human populations” with the goal of gaining a better understanding of disease causation and disease prevention in groups of individuals. Magistrini, 180 F. Supp. 2d at 590. To this end,

[e]pidemiological evidence identifies agents that are associated with an increased risk of disease in groups of individuals, quantifies the amount of excess disease that is associated with an agent, and provides a profile of the type of individual who is likely to contract a disease after being exposed to an agent. The focus of epidemiology is on general causation (i.e., is the agent in question capable of causing disease?) and not specific causation (i.e., did the agent cause a disease in a particular individual?).

Id. (quotation omitted). As the trial court recognized, and as noted above, epidemiological studies can assist in demonstrating a general association between a substance and a disease or condition, but they cannot prove that a substance actually caused a disease or condition in a particular individual. Merrell Dow Pharms., Inc. v. Havner, 953 S.W.2d 706, 715 (Tex. 1997); see also M. Green et al., Reference Guide on Epidemiology, in Reference Manual on Scientific Evidence 333, 381 (Federal Judicial Center ed., 2d ed. 2000), available at <http://www.fjc.gov> (“Epidemiology is concerned with the incidence of disease in populations and does not address the question of the cause of an individual’s disease. This question, sometimes referred to as specific causation, is beyond the domain of the science of epidemiology.” (footnote omitted)).

¶ 19. Notwithstanding this limitation, numerous courts have considered the role that epidemiological studies can play in establishing specific causation. Green, supra, at 382. The existing case law focuses both on the admissibility of epidemiological evidence, as well as whether, and under what circumstances, such evidence could be considered sufficient to meet a plaintiff’s burden of production. Id. According to Green, “[a]n epidemiologic study that is sufficiently rigorous to justify a conclusion that is scientifically valid should be admissible, as it tends to make an issue in dispute more or less likely.” Id. As to sufficiency, Green explains that

[t]he civil burden of proof is described most often as requiring the fact finder to believe that what is sought to be proved is more likely true than not true. The relative risk from epidemiologic studies can be adapted to this 50% plus standard to yield a

probability or likelihood that an agent caused an individual's disease.

Id. at 383 (quotation omitted).[\[6\]](#)

¶ 20. With this background in mind, we turn to the nature of epidemiological studies, generally. Epidemiological studies quantify the degree of association between a given substance and a disease by assigning a “relative risk” factor to the association.[\[7\]](#) See Hall v. Baxter Healthcare Corp., 947 F. Supp. 1387, 1403 (D. Or. 1996). “When the relative risk reaches 2.0, the risk has doubled, indicating that the risk is twice as high among the exposed group as compared to the non-exposed group.” Magistrini, 180 F. Supp. 2d at 591. Thus, “the threshold for concluding that an agent was more likely than not the cause of an individual's disease is a relative risk greater than 2.0.” *Id.* (quotation omitted). The trial court here adopted a relative risk factor of 2.0 as a benchmark, finding that it easily tied into Vermont's “more likely than not” civil standard and that such a benchmark was helpful in this case because the eight epidemiological studies relied upon by claimant's experts reflected widely varying degrees of relative risk.

¶ 21. The trial court found that only two of the eight epidemiological studies relied upon by the experts in this case reflected a relative risk greater than 2.0—Figgs and Sama—while the remaining six showed “little or no association” between firefighting and lymphomas. Notwithstanding the results of these studies, Dr. Guidotti opined that firefighting was in fact what caused claimant's lymphoma. Other than an undefined reference to “weight-of-the-evidence methodology,” however, the court could not discern the scientific method that Dr. Guidotti used to reach his conclusion. The court also noted that the studies that Dr. Guidotti relied upon may have been overinclusive, reflecting associations between other types of lymphomas and generic cancers in firefighters.[\[8\]](#) For these reasons, the court could not find that Dr. Guidotti's testimony was based upon sufficient facts or data or that he applied the principles of epidemiological analysis reliably to this case. See V.R.E. 702(1), (3).

¶ 22. The court was equally unpersuaded by the “meta-analysis” conducted by Dr. Lockey and Dr. LeMasters. See Knight v. Kirby Inland Marine, Inc., 363 F. Supp. 2d 859, 866 n.13 (N.D. Miss. 2005) (explaining that meta-analysis is a technique that “pools the results of multiple studies to arrive at a single figure representative of all of the studies reviewed”). The court found that these doctors used a similarly-undefined “weight-of-the-evidence” approach to attempt to demonstrate a general association between firefighting and NHL. They failed to make their analysis accessible to the court, however, and the court consequently found it impossible to conclude that the meta-analysis was a reliable scientific method, reproducible by others in the field, and not specifically done for the purpose of this litigation, to counter the various studies' inherent contradictions with respect to relative risk.

¶ 23. The court also found that of the thirty-two studies included in the meta-analysis, only eight dealt with lymphoma. The court could not discern if Dr. Lockey and Dr. LeMasters' opinions as to claimant were based upon the meta-analysis of the thirty-two studies, including all types of cancers, or only on the eight dealing specifically with lymphoma. The court noted,

moreover, that Dr. Lockey and Dr. LeMasters asserted in their study only that there was a general association between firefighting and lymphoma, but not that claimant's work as a firefighter actually caused him to develop NHL. Thus, the court found that the meta-analysis failed the third prong of Rule 702, which requires that the experts apply the scientific method reliably to the facts of the case. Indeed, the court found, claimant's brief stated as much, at least with respect to Dr. LeMasters, indicating that she "felt it was beyond her expertise to apply epidemiological evidence to an individual's medical condition to arrive at an informed expert opinion on 'specific causation.'" "

¶ 24. Finally, the court reasoned that even if the meta-analysis conducted by Dr. Lockey and Dr. LeMasters was a reliable scientific method, which it may have been, the court had no way to know if it was based upon sufficient facts or data as required by Rule 702(1). As stated above, these experts were not persuasive in presenting their findings, and the court could not determine which studies of which cancers were included in the meta-analysis.

¶ 25. Claimant challenges these findings and conclusions on appeal. We begin with the court's evaluation of Dr. Guidotti's testimony. Claimant raises two related arguments. First, he asserts that the court should not have used a relative risk of 2.0 as a benchmark in evaluating whether the experts' testimony was based on sufficient facts or data. He also maintains that the court erred in stating that six of the epidemiological studies he offered showed "little or no association" between NHL and firefighting. In a related vein, claimant argues that, contrary to the trial court's finding, Dr. Guidotti adequately explained his methodology, and his reliance on a "weight of the evidence" methodology was scientifically acceptable. Claimant argues that the court should have credited Dr. Guidotti's explanation of why the "true risk" ratio for the type of cancer suffered by claimant "probably exceeds 2.0," notwithstanding the results in the majority of the epidemiological studies upon which he relied.[\[9\]](#)

¶ 26. We find these arguments without merit. Claimant was required to show by a preponderance of the evidence that his NHL was causally related to his employment. To meet his burden of proof, claimant relied on epidemiological studies, studies that focus on general causation rather than specific causation. Dr. Guidotti acknowledged that the demonstration of "more likely than not" in the epidemiological literature corresponded to a relative risk, or an odds ratio, of 2.0, although he argued that this standard should not be followed here.[\[10\]](#) Given claimant's burden of proof, however, and the inherent limitations of epidemiological data in addressing specific causation, the trial court reasonably found the 2.0 standard to be a helpful benchmark in evaluating the epidemiological evidence underlying Dr. Guidotti's opinion. See Magistrini, 180 F. Supp. 2d at 595 (in determining admissibility of expert testimony, the trial court must "examine the expert's conclusions in order to determine whether they could reliably flow from the facts known to the expert and the methodology used." (quotation omitted)).

¶ 27. Other courts have similarly looked to the 2.0 standard in evaluating epidemiological evidence. See Havner, 953 S.W.2d at 716 (concluding that properly designed and executed epidemiological studies may be part of the evidence supporting causation in a toxic tort case, and finding a rational basis for relating the requirement that there be more than a "doubling of the risk" to the "more likely than not" burden of proof) (citing cases where other courts have found that "the requirement of a more than 50% probability means that epidemiological evidence must

show that the risk of an injury or condition in the exposed population was more than double the risk in the unexposed or control population”); see also Daubert v. Merrell Dow Pharms., Inc. (Daubert II), 43 F.3d 1311, 1321 (9th Cir. 1995) (“For an epidemiological study to show causation under a preponderance standard, the relative risk . . . arising from the epidemiological data will, at a minimum, have to exceed 2.” (quotation omitted)); Sanderson v. Int’l Flavors & Fragrances, Inc., 950 F. Supp. 981, 998 n.17 (C.D. Cal. 1996) (plaintiff must show more than that certain chemical increased somewhat the likelihood of particular injury; he or she must show that it more than doubled the risk—this would then offer support for an opinion that it was more likely than not the source of plaintiff’s injury); Magistrini, 180 F. Supp. 2d at 605 n.27 (“[M]any courts confronted with determining the reliability of expert testimony look at whether or not the studies relied upon by the expert are statistically significant.”) (citing Joiner, 522 U.S. at 145-46 (evaluating reliability of epidemiological data based on statistical significance); In re TMI Litig., 193 F.3d 613, 711-12 (3d Cir. 1999) (finding epidemiology study unreliable because results not statistically significant)). Indeed, the Daubert II court found that a relative risk of less than two “actually tends to disprove legal causation,” as it shows that the agent in question does not double the likelihood of developing a particular injury. 43 F.3d at 1321. Thus, as the court explained, epidemiological studies showing a relative risk less than two “would not be helpful, and indeed would only serve to confuse the jury, if offered to prove rather than to refute causation.” Id.

¶ 28. We also recognize that the very use of epidemiological evidence to show specific causation reflects a compromise, given that epidemiological studies “cannot indicate the actual cause of a given individual’s disease or condition.” Havner, 953 S.W.2d at 718. As the Havner court persuasively reasoned,

the law must balance the need to compensate those who have been injured by the wrongful actions of another with the concept deeply imbedded in our jurisprudence that a defendant cannot be found liable for an injury unless the preponderance of the evidence supports cause in fact. The use of scientifically reliable epidemiological studies and the requirement of more than a doubling of the risk strikes a balance between the needs of our legal system and the limits of science.

Id. Mindful of this balance, we conclude that the trial court did not abuse its discretion in considering a relative risk greater than 2.0 as a reasonable and helpful benchmark under the circumstances presented here.

¶ 29. We view the court’s finding of “little or no association” between lymphomas and firefighting in six of the eight epidemiological studies in the context of its discussion of statistically significant risks. While “association” may have been the wrong word, we reject claimant’s assertion that the court’s use of this term reflects a fundamental misunderstanding of the scientific data.^[11] We note, moreover, that claimant’s own expert, Dr. Lockey, testified that there was no association shown between firefighting and NHL if one looked at the Baris, Demers, and Aronson studies individually. Additionally, the Baris and Giles studies included the

number 1.0 in the range of possible values for relative risk between NHL and firefighting, which illustrates the lack of a statistically significant association. See In re Viagra Prods. Liab. Litig., 572 F. Supp. 2d 1071, 1078-79 (D. Minn. 2008) (“It is generally accepted that if the confidence interval is so great that it includes the number 1.0, then the study will be said to show no statistically significant association between the factor and the disease.” (quotation omitted)).^[12] Claimant fails to show that the court’s statement constitutes reversible error.

¶ 30. We turn next to the specific methodology employed by Dr. Guidotti in reaching his conclusion that firefighting caused claimant’s NHL. Dr. Guidotti stated that his opinion was based on his “interpretation of the literature.” He maintained that his interpretation was supported by “available evidence in the extant literature,” and he later reiterated his conclusion that “the weight of evidence favors the interpretation that [claimant’s] lymphoma arose from work as a firefighter.” As noted above, claimant argues that Dr. Guidotti’s methodology was sound. The court concluded otherwise, finding that Dr. Guidotti’s opinion was not based on sufficient facts or data, and that Dr. Guidotti had not applied scientific principles and methods reliably to the facts of this case. The court did not abuse its discretion in reaching its conclusion. See USGen New Eng., Inc. v. Town of Rockingham, 2004 VT 90, ¶ 24, 177 Vt. 193, 862 A.2d 269 (party claiming abuse of discretion must show that court’s decision was “made for reasons clearly untenable” or that it was “unreasonable”).

¶ 31. It is true, as claimant asserts, that other courts have discussed a “weight-of-the-evidence” approach. Yet those courts have also required far more information in support of such an approach than Dr. Guidotti provided here. As is often repeated, there must be “a scientific method of weighting that is used and explained,” Magistrini, 180 F. Supp. 2d at 607, and an expert’s opinion cannot be based “on subjective belief or unsupported speculation.” Id. at 594 (quotation omitted). By detailing the weight given to each component, an expert demonstrates that “the ‘weight-of-the-evidence’ methodology is truly a methodology, rather than a mere conclusion-oriented selection process that weighs more heavily those studies that supported an outcome.” Id. at 607.

¶ 32. In Magistrini, for example, an expert witness proposed to testify, based on a weight-of-the-evidence analysis, that the plaintiff’s leukemia was caused by her exposure to a particular chemical. Id. at 599-601. The court found the testimony inadmissible, finding “the single most serious flaw [in the expert testimony] is the most basic: [the expert] simply has not set forth the methodology he used to weigh the evidence.” Id. at 606. As the Magistrini court explained, “because the weight-of-the-evidence methodology involves substantial judgment on the part of the expert, it is crucial that the expert supply his method for weighting the studies he has chosen to include in order to prevent a mere listing of studies and jumping to a conclusion.” Id. at 602. In Magistrini, the expert’s “failure to adequately address the relative risks found in the studies that he relied on weigh[ed] heavily in th[e] Court’s ultimate conclusion that his methodology [was] not sufficiently reliable to pass through the ‘gate’ to the jury.” Id.

¶ 33. The trial court was faced with a similar situation here. Dr. Guidotti did not specify the precise weight he gave to each study or how he reached his conclusion that the studies, taken together, demonstrated a statistically significant result, when seventy-five percent of the studies, individually, failed to reach that conclusion. Dr. Guidotti stated that his analysis was “based on

the observation that improving the accuracy of cumulative exposure to combustion products in whatever data set is available results in an increased estimate of risk, which reflects the strength of association.” He opined that “[i]n the key studies available, a career of 40 years clearly places a firefighter at increased risk of NHL and is sufficient to conclude that the risk was in fact elevated to at least an approximate doubling.” How? Why? Dr. Guidotti failed to specifically account for the level of relative risk shown by each of the studies, describe what precise weight was given to each study, particularly in light of the different types of studies involved, or account specifically for showings such as that found in the Baris study that the level of excess risk of NHL was not associated with an increased number of lifetime runs, and that, in fact, the standardized mortality ratio was highest in those individuals who made the lowest number of firefighting runs.

¶ 34. As the United States Supreme Court has recognized, the very purpose of Daubert “is to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field.” Kumho Tire Co. v. Carmichael, 526 U.S. 137, 152 (1999). Where six of eight epidemiological studies did not show a statistically significant risk, it was reasonable for the trial court to conclude that Dr. Guidotti’s expert opinion that claimant’s NHL was more likely than not caused by firefighting lacked a solid and reliable foundation. See id. at 151 (“The trial judge must have considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable.”).

¶ 35. Claimant suggests for the first time on appeal that specific causation is established by the Figgs and Sama studies alone. Claimant’s experts made no such assertion below, however, and we will not address this argument for the first time on appeal. See Lane v. Town of Grafton, 166 Vt. 148, 153, 689 A.2d 455, 457 (1997) (“Failure to raise a reason why summary judgment should not be granted at the trial level precludes raising it on appeal.”). Indeed, we note that this position is at odds with the weight-of-the-evidence approach taken by both Dr. Guidotti and Dr. Lockey. In fact, Dr. Lockey specifically testified that he would not rely on just one study to reach a conclusion, as that would be inadequate grounds on which to base an opinion.

¶ 36. Of course, we are not blind to fundamental misapplications of Daubert but claimant fails to show that is what occurred here. See USGen, 2004 VT 90, ¶ 24 (Supreme Court will affirm the trial court’s decision “[a]bsent a clear showing of judicial error,” but Court will also “engage in a substantial and thorough analysis of the trial court’s decision and order to ensure that the trial judge’s decision was in accordance with Daubert and our applicable precedents” (quotation omitted)). The requirement that an expert testify to “scientific knowledge means that the expert’s opinion must be based on the ‘methods and procedures of science’ rather than on ‘subjective belief or unsupported speculation’; the expert must have ‘good grounds’ for his or her belief.” Magistrini, 180 F. Supp. 2d at 594. “[W]hen an expert opinion is based on data, a methodology, or studies that are simply inadequate to support the conclusions reached, Daubert and Rule 702 mandate the exclusion of that unreliable opinion testimony.” Amorgianos v. Nat’l R.R. Passenger Corp., 303 F.3d 256, 266 (2d Cir. 2002). The trial court identified reasonable grounds for its decision, and as we have often repeated, it is for the trial court, not this Court, to weigh the evidence and assess the credibility of witnesses. See, e.g., Chase v. Bowen, 2008 VT 12, ¶ 15, 183 Vt. 187, 945 A.2d 901 (it is exclusively the province of the trial court to assess the

credibility of the witnesses and weigh the persuasiveness of the evidence). We find no abuse of discretion in its exclusion of Dr. Guidotti's testimony here.

¶ 37. We next consider the court's evaluation of the meta-analysis conducted by Dr. Lockey and Dr. LeMasters. Claimant maintains that the court mischaracterized the methodology and scientific reliability of this study. Claimant also asserts that, contrary to the court's statement that it could not discern what studies were included, it was clear from the "summary risk estimate" that eight studies were used in the analysis of the association between NHL and firefighting.

¶ 38. While it is not entirely clear from the introduction to the meta-analysis, it does appear, as claimant argues, that the meta-analysis with respect to NHL was based on eight studies, apparently the same eight studies used by Dr. Guidotti in reaching his conclusion. The meta-analysis found the summary risk estimate for NHL to be 1.51, again a value less than 2.0. The study concluded that the findings of an association between firefighting and significant increased risk for specific types of cancer raised red flags and should encourage further development of innovative comfortable protective equipment, allowing firefighters to do their jobs without compromising their health. A conclusion that NHL is considered a "probable cancer risk" for firefighters is not sufficient to establish that claimant's NHL was caused by firefighting, particularly given that this conclusion rests on a finding of relative risk of less than 2.0. See Sanderson, 950 F. Supp. at 1000 (where expert's probability estimate was "not founded upon epidemiological studies showing a relative risk of greater than two, or some other evidence that would lend a scientific foundation to the assertion that [a particular agent] more likely than not caused plaintiff's injuries, it does not constitute a valid scientific connection to the pertinent inquiry of causation" (quotation omitted)). As the trial court found, moreover, the study did not in fact assert that firefighting caused claimant's NHL, and Dr. Lockey failed to adequately explain how this study showed that it was more likely than not that firefighting caused claimant's cancer. See Daubert II, 43 F.3d at 1322 (in order for expert testimony of causation to have a valid scientific connection to the pertinent inquiry, it must demonstrate that exposure to agent actually caused plaintiff's injuries or, at least, that such exposure more than doubled plaintiff's risk of suffering those injuries; otherwise expert testimony does not assist the trier of fact in resolving the issue of causation).

¶ 39. We reject claimant's assertion that the trial court misapprehended the foundation of Dr. Lockey's testimony. According to claimant, Dr. Lockey did not rely solely on meta-analysis in reaching his conclusion that claimant's NHL was caused by firefighting. Rather, claimant argues, Dr. Lockey stated that he examined the potential exposures experienced by firefighters; he considered whether there were any non-occupational factors as applied to claimant that were known to be associated with a risk for NHL; and he examined all of the published and peer-reviewed medical literature as it applied to firefighters and the occurrence of NHL. According to claimant, Dr. Lockey found that the majority of studies demonstrated a significantly elevated risk from a statistical perspective, but not at a statistically significant level. Claimant asserts that, in Dr. Lockey's expert opinion, the scientific data demonstrated a consistent cause-effect relationship between firefighting and NHL.

¶ 40. Dr. Lockey may have testified as to other things, but his conclusion as to causation plainly rested, as it must, on his evaluation of the scientific evidence, which here, was his interpretation of epidemiological studies. Our law requires claimant to show, not merely that firefighting increased the likelihood of injury, but that it more likely than not caused his disease. See id. (expressing similar sentiment). Claimant failed to establish good grounds for such a conclusion here. We need not consider Dr. LeMasters' testimony separately because she had no opinion whether claimant's NHL was caused by firefighting, and thus, her opinion alone would be insufficient to meet claimant's burden of proof. The fact that she was not a physician, and thus, incapable of opining as to causation, is irrelevant.

¶ 41. As set forth above, the trial court was obligated to evaluate the reliability and relevance of the proposed expert testimony. The Legislature has recognized the difficulty in establishing causation in cases similar to this one, and it has changed the way in which such cases will be evaluated in the future. See 2007, No. 42, § 1 (recognizing that establishing causation requires significant expert testimony and that it is difficult and expensive to gather and establish evidence of work-related causation for certain types of cancers suffered disproportionately by firefighters). In this case, however, there was no presumption of causation available to claimant, and we conclude that the court acted within its discretion in excluding the expert testimony at issue here. As one court has explained,

[o]ur legal system requires that claimants prove their cases by a preponderance of the evidence. In keeping with this sound proposition at the heart of our jurisprudence, the law should not be hasty to impose liability when scientifically reliable evidence is unavailable. As Judge Posner has said, "law lags science; it does not lead it."

Havner, 953 S.W.2d at 728; see also Sanderson, 950 F. Supp. at 1004 (while keeping doubtful science out of law will on occasion prevent factfinder from learning of authentic insights and innovations, Rule 702 reflects the balance struck between the needs of science and the needs of law, and framers of Rule 702 "did well to make law a prisoner to science, not the other way around"). Without evidence of specific causation, summary judgment was properly granted to insurer.

Affirmed.

FOR THE COURT:

Associate Justice

¶ 42. **DOOLEY, J., concurring.** I agree with the majority opinion that decides this case more as an adequacy-of-proof case than an admissibility-of-evidence case. This is exactly how the Commissioner of Labor decided the case, because no issue of evidence admissibility was raised there.^[13] As the majority opinion explains, the evidence was inadequate to show specific causation, and summary judgment was properly granted. I cannot agree with the dissent that this Court, the superior court and the Commissioner “have exceeded their proper roles in this case and evaluated the evidence put forward by claimant to determine whether claimant should ultimately prevail on the merits.” *Post*, ¶ 47. I agree with the Commissioner that “it is merely possible, not probable” that claimant’s firefighter work caused his lymphoma.

¶ 43. I write in concurrence only to point out that this is another in the line of cases that attempts to resolve appellate jurisdiction in workers’ compensation cases based on unworkable and inconsistent distinctions. See *Stoll v. Burlington Elec. Dep’t*, 2009 VT 61, ¶ 11, ___ Vt. ___, 977 A.2d 1282 (Dooley, J., dissenting). The majority says that the fact that judgment was granted as a matter of law in this case does not mean the case should have been appealed to this Court under 21 V.S.A. § 672, rather than to the superior court, because the superior court’s “inquiry under Rule 702 was plainly fact-based.” *Ante*, ¶ 13. Whether an evidentiary ruling, or a ruling on the adequacy of the evidence to reach a fact-finder, is “fact-based” is beside the point. Since the evidentiary issue arose only during the superior court appeal, it cannot be the basis to hold that claimant should have appealed to this Court in the first instance. Moreover, even if we look at the superior court’s evidentiary ruling, that ruling is one of law—it clearly is such that our review here is a “review of questions of law.” 21 V.S.A. § 672. All evidentiary rulings are “fact-based,” but that does not make them rulings on questions of fact.

¶ 44. The real inquiry here should be into the nature of the Commissioner’s decision on appeal. As I noted above, the Commissioner looked at all the evidence and ruled that “it is merely possible, not probable” that claimant’s firefighter work caused his lymphoma. This ruling was the functional equivalent of granting judgment as a matter of law to insurer. Thus, the Commissioner was saying that even if she believed every bit of evidence offered by claimant it was not enough to get claimant over the line from possibility to probability. Just like the decision of the superior court, the Commissioner’s decision is one of law, not fact. Under *Stoll*, 2009 VT 61, ¶¶ 7-8, this case was appealed to the wrong court, and the appeal should be dismissed. The majority’s rationale for distinguishing *Stoll* and the statute puts more mud in muddy water.

¶ 45. I am concurring because, whatever the rationale for the majority’s decision, we should allow cases like this to go to the superior court and not require that they go exclusively to this Court. This case represents some loosening of the rigid rule of *Stoll*; how much and in what way remains to be seen.

¶ 46. **REIBER, C.J., dissenting.** I cannot agree with the majority’s decision to affirm the trial court’s conclusion that summary judgment was appropriate after it improperly excluded claimant’s expert opinions. In addition, where the trial court appeared to be confused about the meta-analysis, it should have held a Daubert hearing or at least engaged in further review of the submitted materials. I would reverse and remand this case.

¶ 47. It is telling that the concurring opinion summarizes the majority as deciding this appeal “more as an adequacy-of-proof case than an admissibility-of-evidence case.” Ante, ¶ 42. That statement is unfortunately true: both the trial court and the majority have exceeded their proper roles in this case and evaluated the evidence put forward by claimant to determine whether claimant should ultimately prevail on the merits. As the concurrence states, the trial court and the majority have concluded that “the evidence was inadequate.” Id. The problem is that this is a merits determination that should have been put to the jury. If the concurring opinion is correct that this is about the adequacy—not the admissibility—of the evidence, then on summary judgment we must view all of that evidence “in a light most favorable to” claimant. In re Carroll, 2007 VT 73, ¶ 8, 182 Vt. 571, 933 A.2d 193 (quotation omitted). Viewing the evidence this way, we would have no choice other than to accept as true the expert opinions of the two highly qualified medical doctors who have explicitly stated that it is more likely than not that claimant’s non-Hodgkin’s lymphoma was caused by his firefighting. Thus, insurer cannot possibly prevail on summary judgment if this case is analyzed in terms of whether a reasonable jury could find the evidence adequate.

¶ 48. The only way that insurer could prevail on summary judgment is if the expert opinions of both of claimant’s medical doctors are held to be inadmissible. Perhaps it is the foundation for the medical doctor’s opinions that the majority and the concurrence find “inadequate.” Ante, ¶ 42. Regarding that question—a question of admissibility—the only way to dismiss the medical doctors’ opinions here would be if there were “too great an analytical gap between the data and the opinion[s] proffered.” Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997). This is the crux of the issue. The trial court held that the gap was too great here because claimant did not have studies meeting the 2.0 relative risk standard. I agree that the 2.0 standard corresponds with the ultimate issue that must be decided on the merits: whether it is more likely than not that claimant’s non-Hodgkin’s lymphoma was caused by firefighting. The problem is that it is not the standard for admissibility.

¶ 49. The standard for admissibility is whether there is too great a gap between the studies offered and the medical doctor’s opinions based in part on those studies. Id. But here, there is no gap at all: two of the studies relied upon by the doctors—the Figgs study and the Sama study—show statistically significant results that meet even the trial court’s strict 2.0 admissibility standard.^[14] Those studies directly support the doctors’ conclusions that it is more likely than not that claimant’s non-Hodgkin’s lymphoma was caused by firefighting. The doctors’ opinions are therefore admissible. That should be the end of the admissibility analysis. But even where there is a gap between the studies and the doctors’ opinions, as there is for those studies which show a relative risk of less than 2.0, that gap is more than filled here by specific knowledge about claimant that makes it more likely that claimant’s non-Hodgkin’s

lymphoma was caused by firefighting. Finally, to the extent that the trial court believed that there still existed an analytical gap, the gap was “of the . . . court’s making” for failing to hold a Daubert hearing or at least engage in further review of the submitted materials to clear up the court’s confusion. Kennedy v. Collagen Corp., 161 F.3d 1226, 1230 (9th Cir. 1998). The materials put forward by claimant, even if not all admissible, included numerous admissible studies and admissible factual details about claimant that provided a more-than-adequate foundation for the medical doctors’ opinions regarding specific causation. Those opinions therefore should have gone to the jury, and the trial court should not have dismissed this case on summary judgment.

¶ 50. The trial court’s summary judgment decision is premised on its erroneous exclusion of claimant’s expert testimony linking claimant’s firefighting service to non-Hodgkin’s lymphoma. It is undisputed that claimant’s three experts here—one epidemiologist and two medical doctors—are well qualified. Indeed, they are arguably some of the most qualified experts in their respective fields.^[15] The conclusions of claimant’s experts—relating claimant’s death from non-Hodgkin’s lymphoma to his forty years fighting fires—are not a type of “junk science.” 985 Assocs., Ltd. v. Daewoo Elecs. Am., Inc., 2008 VT 14, ¶ 10, 183 Vt. 208, 945 A.2d 381. To the contrary, these opinions rely on sound methodologies and are in line with what has become generally accepted in the scientific community.^[16]

¶ 51. The opinions offered by claimant’s experts were based on numerous statistically significant scientific studies with confidence intervals for relative risk entirely above 1.0. Those studies, published in peer-reviewed scientific journals, are routinely used by experts to determine the issue litigated here. The studies—and the expert opinions based upon them—were therefore both reliable and relevant. The trial court should have permitted this statistically significant evidence to be presented to a jury and then let the jury decide whether it was sufficient to carry claimant’s burden. In excluding the opinion evidence based upon these studies, and in adopting the 2.0 relative risk standard as a test for admissibility, the trial court overstepped its gatekeeper role and decided questions that should have been left to the jury. In addition, in applying the 2.0 relative risk standard, the trial court, without any explanation, ignored at least two statistically significant studies that the experts relied upon that exceeded that same 2.0 standard.

¶ 52. There are several defects in the trial court’s decision, but the main problem is that it ignores Vermont’s limitation on the gatekeeping role of trial courts in evaluating expert testimony. By failing to limit itself to adopting a legal standard for statistical significance, and instead adopting the requirement that each study meet the 2.0 standard—meaning a doubling of the risk, which is the same standard for showing at the merits stage that causation is more likely than not—the trial court improperly thrust itself into a merits determination. This Court has squarely stated that trial courts should not engage in “a preliminary inquiry into the merits of the case.” Daewoo, 2008 VT 14, ¶ 10. Although the trial court claimed to use the 2.0 relative risk standard merely as a “benchmark,” it applied a hard-line 2.0 standard for the admittance of any epidemiological study.^[17] Thus, there was no “benchmark” involved here; to the contrary, the trial court established a misplaced bright-line rule and an improper legal standard for admissibility.

¶ 53. Specifically, the trial court abused its discretion in the following ways: (1) by conducting a preliminary inquiry into the merits of the case and adopting a standard requiring that each piece of evidence be sufficient to make claimant’s entire case; (2) by ignoring the fact that two doctors looked at a number of health-related factors that were peculiar to claimant and based their opinions on these factors; (3) by failing to explain why the standard the court adopted was not met here, at least as to two studies that were both statistically significant and exceeded the court’s 2.0 relative risk standard; and (4) by failing to hold a Daubert hearing or further engage in the submitted materials, especially given the trial court’s apparent confusion about numerous aspects of the proffered testimony regarding the meta-analysis.

I.

¶ 54. The majority is correct that we review trial court decisions excluding evidence for abuse of discretion. USGen New Eng., Inc. v. Town of Rockingham, 2004 VT 90, ¶¶ 21-23, 177 Vt. 193, 862 A.2d 269.^[18] That said, this Court has specifically noted that “we cannot allow our deferential standard of review to blind us to fundamental misapplications of the Daubert analysis.” Daewoo, 2008 VT 14, ¶ 9. Thus, we have held reviewing for abuse of discretion does not prevent us from “engage[ing] in a substantial and thorough analysis of the trial court’s decision and order to ensure that the trial judge’s decision was in accordance with Daubert and our applicable precedents.” USGen, 2004 VT 90, ¶ 24 (quotation omitted); cf., e.g., United States v. Pansier, 576 F.3d 726, 737-38 (7th Cir. 2009) (noting that appellate courts do not apply any deference in determining “whether the [trial] court applied the legal framework required under Rule 702 and Daubert”). Further, if there is an “arguable lack of clarity in our case law”—as there is here, where the trial court recognized that this was an issue of first impression—and if the trial court resolved legal questions incorrectly, we must reverse and remand for an application of the correct legal standard. DeYoung v. Ruggiero, 2009 VT 9, ¶ 31, 185 Vt. 267, 971 A.2d 627; see also, e.g., United States v. Snyder, 136 F.3d 65, 67 (1st Cir. 1998) (holding that a per se abuse of discretion occurs when a trial court commits an error of law). In my view, the trial court applied the wrong legal standard and violated several of our applicable precedents when it adopted the 2.0 relative risk standard for determining whether to admit epidemiological studies.

¶ 55. We have previously stated that “the trial court’s inquiry into expert testimony should primarily focus on excluding ‘junk science’—because of its potential to confuse or mislead the trier of fact—rather than serving as a preliminary inquiry into the merits of the case.” Daewoo, 2008 VT 14, ¶ 10; accord In re Appeal of JAM Golf, LLC, 2008 VT 110, ¶ 11, 185 Vt. 201, 969 A.2d 47 (“In finding evidence to be reliable, the trial court is not expected to make a substantive decision on the merits of the proponent’s argument but is instead required to make an inquiry into the factual basis and methodology used by the expert witness.” (quotation omitted)); see also, e.g., Kennedy, 161 F.3d at 1228 (finding an abuse of discretion where “the trial court failed to distinguish between the threshold question of admissibility of expert testimony and the persuasive weight to be accorded such testimony by a jury”). Thus, where a trial court “cannot conclude that [an expert’s] testimony is the kind of ‘junk science’ that Daubert meant to exclude,” the evidence should be admitted. JAM Golf, 2008 VT 110, ¶ 11.

¶ 56. The trial court's role here is limited because evaluating an expert's "credibility and [the] weight of the evidence [is] the ageless role of the jury." McCullock v. H.B. Fuller Co., 61 F.3d 1038, 1045 (2d Cir. 1995). Thus, this Court has "emphasize[d] . . . that Daubert presents an admissibility standard only." USGen, 2004 VT 90, ¶ 19. The Daubert Court itself noted that "[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence." Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 596 (1993); see also, e.g., Ruiz-Troche v. Pepsi Cola of P.R. Bottling Co., 161 F.3d 77, 85 (1st Cir. 1998) ("Daubert does not require that a party who proffers expert testimony carry the burden of proving to the judge that the expert's assessment of the situation is correct. As long as an expert's scientific testimony rests upon 'good grounds, based on what is known,' it should be tested by the adversary process—competing expert testimony and active cross-examination—rather than excluded from jurors' scrutiny for fear that they will not grasp its complexities or satisfactorily weigh its inadequacies." (quoting Daubert, 509 U.S. at 590)); McCullock, 61 F.3d at 1044 ("Disputes as to the strength of [an expert witness's] credentials, faults in his use of differential etiology as a methodology, or lack of textual authority for his opinion, go to the weight, not the admissibility, of his testimony."). This Court has similarly stated that "to tease out deficiencies of expert testimony, opponents should attack testimony of this nature through the adversarial process," rather than through excluding the evidence altogether. JAM Golf, 2008 VT 110, ¶ 9.

¶ 57. The trial court's adoption of the 2.0 relative risk standard as the threshold for admitting evidence of epidemiological studies, with no consideration of a study's statistical significance, goes far enough in passing judgment on the evidence to amount to an evaluation of the merits of the case, rather than a proper inquiry into the methodology and reliability of the studies used by the experts. Whether it is more likely than not that claimant's firefighting caused his non-Hodgkin's lymphoma is the exact fact question that must be resolved on the merits.

¶ 58. The 2.0 standard for admissibility is also problematic because it sets a threshold that requires each study to prove that claimant should win on the merits. By definition, the 2.0 standard only admits each study if that study independently meets the more-likely-than-not standard for proving causation. But we have said: "The admitted evidence does not alone have to meet the proponent's burden of proof on a particular issue." USGen, 2004 VT 90, ¶ 19; see also, e.g., In re Paoli R.R. Yard PCB Litig., 35 F.3d 717, 744 (3d Cir. 1994) ("The evidentiary requirement of reliability is lower than the merits standard of correctness."). In Daewoo, we distinguished "[t]he central issue [of] the admissibility of the proffered expert testimony," from "the sufficiency of the evidence in proving plaintiffs' case." 2008 VT 14, ¶ 13. By requiring each study to show—on its own—that it is more likely than not that claimant's cancer was caused by firefighting, the trial court failed to recognize that claimant is free to combine various pieces of evidence to make his case. While for purposes of summary judgment under Vermont Rule of Civil Procedure 56 the trial court's focus is properly on the sufficiency of the uncontroverted evidence to meet the non-moving party's burden of proof, in this instance the trial court's exclusion of the expert opinions conflated the court's roles as gatekeeper and as Rule 56 decision-maker, resulting in an improper focus on the sufficiency of the opinion evidence, rather than on its admissibility. Id.

¶ 59. The trial court’s analysis appears to stem in part from a mistaken belief that an epidemiological study that fails to meet the 2.0 relative risk standard is not statistically significant. That is simply not true. Statistical significance and relative risk are two different concepts, and a doubling of the risk is not required for a study to be statistically significant. The Second Circuit Court of Appeals has flatly rejected the idea that even a 1.5 relative risk is required for a study to be statistically significant. In re Joint E. & S. Dist. Asbestos Litig., 52 F.3d 1124, 1134 (2d Cir. 1995). In Joint Eastern, when the district court held that epidemiological studies with a relative risk of less than 1.5 were statistically insignificant, the Second Circuit rejected this “bold assertion” and held that “it would be far preferable for the district court to instruct the jury on statistical significance and then let the jury decide whether . . . studies over the 1.0 mark have any significance in combination.” Id.; see also, e.g., Pick v. Am. Med. Sys., Inc., 958 F. Supp. 1151, 1160 (E.D. La. 1997) (holding that a study with a “relative risk above 1.0 . . . even if not sufficient, by itself” can be used to “establish causation by a preponderance of the evidence”).

¶ 60. In summarizing its holding, the Joint Eastern court noted that the trial court “erred . . . in rendering independent assessments of the epidemiological evidence far beyond the role authorized by Daubert; in rejecting all epidemiological studies that yielded [a relative risk] below the unexplained floor of 1.50; . . . and in generally encroaching upon the factfinding role of the jury.” 52 F.3d at 1139. The same can be said for what the trial court did here. Indeed, here the trial court’s error was more grave because it adopted the higher floor of 2.0 and in doing so went “beyond the role authorized by Daubert.” Id.

¶ 61. Scientists usually determine statistical significance by looking at a study’s confidence interval, rather than the exact relative risk arrived at in a particular study. The confidence interval is generally set at a 95% confidence level and is rendered as a range with endpoints on both sides. The lower endpoint represents the lowest possible relative risk (RR) or odds ratio (OR) that appeared (or would be expected to appear) in repeated trials:

[T]he RR or OR has a “confidence interval” around it that expresses how “stable” the estimate is in repeated trials. A 95% confidence interval is the range of numbers that would include the “real” risk 95 times out of 100 if the same study were done over and over again, allowing for random fluctuations of the data inherent in the selection of subjects. Thus, a RR of 1.8 with a confidence interval [between] 1.3 [and] 2.9 could very likely represent a true RR of greater than 2.0, and as high as 2.9 in 95 out of 100 repeated trials.

R. Clapp & D. Ozonoff, Environment and Health: Vital Intersection or Contested Territory?, 30 Am. J. of Law & Med. 189, 210 (2004).

¶ 62. The confidence interval is important because it speaks to whether a study is statistically significant. Rather than focusing on the exact relative risk that a study produces, courts engaged in a gatekeeper analysis need to look at a study’s confidence interval. Here, all of claimant’s experts—and the epidemiological studies they relied upon—discussed confidence intervals in

great detail in numerous documents submitted to the trial court. This was good science. The Fifth Circuit Court of Appeals has noted that “a study with a relative risk of greater than 1.0 must always be considered in light of its confidence interval before one can draw conclusions from it.” Brock v. Merrell Dow Pharms., Inc., 874 F.2d 307, 312 (5th Cir. 1989) (emphasis added), modified on reh’g, 884 F.2d 166 (5th Cir. 1989) (per curiam). Yet the trial court’s decision here never even mentions confidence intervals.

¶ 63. It is important to look at confidence intervals because doing so is the best way to determine whether a study’s results are statistically significant. “If the confidence interval is so [wide] that it includes the number 1.0, then the study will be said to show no statistically significant association between the factor and the disease.” Id. The Brock court specifically defined a “statistically significant” epidemiological study as “one whose confidence interval [is entirely above and does] not include 1.0.” Id.[\[19\]](#)

¶ 64. In Daubert, the United States Supreme Court cited Brock with approval as a case where the evidence on causation was insufficient. See Daubert, 509 U.S. at 596. In Brock, all of the studies offered by the plaintiffs had results with a confidence interval that included 1.0 and was therefore too low for statistical significance. The court therefore noted that the “plaintiffs did not offer one statistically significant” study showing an increased risk. Brock, 874 F.2d at 312. The court also found that “[n]o published epidemiological study has found a statistically significant increased risk.” Id. The evidence in the Brock case was therefore not sufficient to permit a trier of fact to make a reasonable inference of causation. Id. at 315. Applying the Brock standard to this case, on the other hand, leads to a different result. Here, claimant has offered numerous statistically significant studies with confidence intervals entirely above 1.0.

¶ 65. The Brock standard is “generally accepted” as the proper way to evaluate whether a study is statistically significant. In re Viagra Prods. Liab. Litig., 572 F. Supp. 2d 1071, 1078-79 (D. Minn. 2008); see also In re Ephedra Prods. Liab. Litig., 393 F. Supp. 2d 181, 199 (S.D.N.Y. 2005) (referring to the “generally accepted standard of a 95% confidence interval above 1.0”). Indeed, the Reference Manual on Scientific Evidence states the same test: “Where the confidence interval contains a relative risk of 1.0, the results of the study are not statistically significant.” M. Green et al., Reference Guide on Epidemiology, in Reference Manual on Scientific Evidence 333, 389 (Federal Judicial Center ed., 2d ed. 2000), available at <http://www.fjc.gov>. The Reference Manual also states that where “the confidence boundaries . . . do not include a relative risk of 1.0, the study does have a positive finding that is statistically significant.” Id. at 361. The reason is that if the 95% confidence interval is entirely above 1.0, then we are at least 95% certain that the agent studied is associated with the disease. Such a study “is ‘statistically significant.’ ” Cook v. Rockwell Int’l Corp., 580 F. Supp. 2d 1071, 1101 (D. Colo. 2006) (citing Green, supra, at 361); accord, e.g., Turpin v. Merrell Dow Pharms., Inc., 959 F. 2d 1349, 1353 n.1 (6th Cir. 1992) (“If . . . the confidence interval spans a range entirely above 1.0 . . . then this interval would be statistically significant.”).[\[20\]](#)

¶ 66. The experts here—all indisputably well qualified in their respective fields—used this standard for determining statistical significance. Claimant’s expert Dr. Guidotti explicitly stated that when the lowest number in the confidence interval “does not include 1.0, [it] means that [the study] is statistically significant.” Similarly, claimant’s expert Dr. Lockey stated that “[f]our of

the seven [studies] were statistically significant (Burnett, Ma, Figgs and Sama) as the confidence intervals around the risk estimates do not include 1.0.” Claimant’s epidemiologist Dr. LeMasters applied the same standard and also stated that the four studies with confidence intervals above 1.0 were statistically significant.

¶ 67. If the trial court wanted to impose a minimum threshold for admissibility, that threshold should have been to require studies to show a statistically significant relationship. See Brock, 874 F.2d at 312.^[21] But the trial court failed to address statistical significance as a screening device.

¶ 68. If a study has a confidence interval in a range that is entirely above 1.0, it is statistically significant, and any questions about the strength of the relationship shown by the study go to the study’s weight, not its admissibility. If the trial court applied this standard here, the experts would be allowed to rely on the Burnett, Ma, Figgs, and Sama studies—all of which had a confidence interval entirely above 1.0. The trial court abused its discretion in excluding those studies.

¶ 69. The Supreme Court of Nebraska recently wrestled with the issue of whether to adopt the 2.0 relative risk standard. See King v. Burlington N. Santa Fe Ry. Co., 762 N.W.2d 24 (Neb. 2009). After a thorough review of existing caselaw and the Reference Manual on Scientific Evidence, the King court “decline[d] to set a minimum threshold for relative risk, or any other statistical measurement, above the minimum requirement that the study show a relative risk greater than 1.0.” Id. at 46. The court correctly concluded that “[i]n short, the significance of epidemiological studies with weak positive associations is a question of weight, not admissibility.” Id. at 46-47.

¶ 70. While “acknowledg[ing] that courts disagree on the appropriate relative risk threshold that a study must satisfy to support a general causation theory,” id. at 45, the King court held that those courts that have adopted the 2.0 standard often “failed to distinguish between general causation and its brother, specific causation,” id. at 46. The trial court here made this exact mistake when it excluded expert testimony based upon peer-reviewed studies simply because—in the trial court’s opinion—those studies did not show a sufficiently strong association between firefighting and non-Hodgkin’s lymphoma.

¶ 71. The King court noted that “general causation addresses whether a substance is capable of causing a particular injury or condition in a population, while specific causation addresses whether a substance caused a particular individual’s injury.” Id. at 34 (emphasis added). Because “a plaintiff must show both general and specific causation,” id., evidence that survives the Daubert test is admissible if it speaks to either general or specific causation. See V.R.E. 401 (“ ‘Relevant evidence’ means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.”); cf., e.g., In re Neurontin Mktg., Sales Practices, & Prods. Liab. Litig., 612 F. Supp. 2d 116, 158 (D. Mass. 2009) (holding that although “the parties’ experts [might] debate the strength and specificity of the association,” the mere fact of establishing a positive association “alone significantly strengthens the Plaintiffs’ case for admission under Daubert”). Thus, it is common for courts to hold that an expert “is qualified to

render an opinion . . . as to general causation, but not as to specific causation.” Burke v. TransAm Trucking, Inc., 617 F. Supp. 2d 327, 334 (M.D. Pa. 2009) (quotation omitted). That would have been an appropriate course for the trial court to take here, allowing the epidemiologist Dr. LeMasters to testify that firefighting is one cause of non-Hodgkin’s lymphoma, as this helps make claimant’s case on general causation. See, e.g., id. That is all that Dr. LeMasters proposed to offer in her testimony. The trial court abused its discretion by excluding such testimony altogether merely because it does not speak to specific causation. Cf., e.g., In re Hanford Nuclear Reservation Litig., 292 F.3d 1124, 1133-37 (9th Cir. 2002) (holding that it was reversible error for the trial court to exclude studies showing less than a doubling of the risk when the plaintiff was only trying to prove general causation).

¶ 72. Further, although “epidemiology focuses on general causation rather than specific causation,” King, 762 N.W.2d at 34-35, epidemiological studies can be combined with specific information about an individual to show specific causation, as both of the medical doctors did here. When the King court surveyed the cases that have adopted the 2.0 standard, it found that “epidemiological evidence appears to have been the only evidence supporting specific causation” in those cases. Id. at 46 (emphasis added). The 2.0 standard makes much more sense when a plaintiff is using epidemiological studies alone to prove specific causation.^[22] But here, as discussed in detail below, claimant’s experts relied on more than just the epidemiological studies.

¶ 73. The trial court abused its discretion by adopting a standard for admissibility that requires each study to make claimant’s entire case. See, e.g., USGen, 2004 VT 90, ¶ 19 (“The admitted evidence does not alone have to meet the proponent’s burden of proof on a particular issue.”). Whenever a trial court “relie[s] on a standard we have determined to be erroneous,” it is an abuse of discretion, and reversal is warranted. Hanford Nuclear, 292 F.3d at 1138.

II.

¶ 74. The trial court’s error in adopting the 2.0 standard stems in part from a misunderstanding of the proffered testimony in this case. The court apparently accepted insurer’s erroneous position that all of claimant’s experts looked only at the epidemiological studies and did nothing to relate those studies to anything particular about claimant. While it is true that the epidemiologist Dr. LeMasters appropriately limited her proposed testimony to the epidemiological studies, each of the medical doctors (Dr. Lockey and Dr. Guidotti) looked at several factors particular to claimant before concluding that it is more likely than not that claimant’s disease was caused by firefighting. As Dr. Guidotti stated, the studies on general causation “inform[] our interpretation of the case, and then we try to bring it down to the particulars of that case, with as much knowledge as we have available.”

¶ 75. Although the trial court is correct that some courts have adopted the 2.0 standard when determining whether to admit epidemiological studies, see, e.g., Merrell Dow Pharms., Inc. v. Havner, 953 S.W.2d 706, 716 (Tex. 1997), those courts that have adopted the 2.0 standard have for the most part done so on the basis of the following passage from the Ninth Circuit’s decision in Daubert v. Merrell Dow Pharmaceuticals, Inc., 43 F.3d 1311 (9th Cir. 1995) (Daubert II):

For an epidemiological study to show causation under a preponderance standard, the relative risk of limb reduction defects arising from the epidemiological data will, at a minimum, have to exceed '2'. That is, the study must show that children whose mothers took Bendectin are more than twice as likely to develop limb reduction birth defects as children whose mothers did not. While plaintiffs' epidemiologists make vague assertions that there is a statistically significant relationship between Bendectin and birth defects, none states that the relative risk is greater than two. These studies thus would not be helpful, and indeed would only serve to confuse the jury, if offered to prove rather than refute causation. A relative risk of less than two may [be] suggest[ive] . . . , but it actually tends to disprove legal causation, as it shows that Bendectin does not double the likelihood of birth defects.

Id. at 1321 (quotation omitted). Indeed, the trial court here cited part of this very passage as a rationale for adopting the 2.0 standard. What the trial court failed to appreciate is that the plaintiffs in Daubert II based their claims solely on statistical studies: "plaintiffs' experts did not seek to differentiate these [particular] plaintiffs from the subjects of the statistical studies." Id. at 1321 n.16. That is not this case. Here, claimant's experts differentiate claimant in numerous ways. As the Daubert II court went on to recognize, "[a] statistical study showing a relative risk of less than two could be combined with other evidence to show it is more likely than not that the accused cause is responsible for a particular plaintiff's injury." Id. (emphasis added). That is what occurred here. Although insurer argues that claimant's experts rely solely on statistics, and although the trial court stated that "Dr. Guidotti's testimony . . . relies solely upon these [epidemiological] studies," the record flatly contradicts this claim. In developing their expert opinions on causation, both Dr. Lockey and Dr. Guidotti considered a number of facts specific to claimant.

¶ 76. First, both doctors considered claimant's extraordinarily long forty years of service as a firefighter. Dr. Lockey specifically looked at the fact that claimant "worked as a fireman for forty years." Similarly, Dr. Guidotti noted that claimant's forty years of exposure "places him in a high-risk category," specifically for non-Hodgkin's lymphoma "among other things." This deposition testimony in itself is sufficient to allow claimant to argue that the epidemiological studies underestimate the real risk that claimant faced through his firefighting and that even studies showing a relative risk of less than 2.0 can therefore support his claim that firefighting more than doubled his risk of getting non-Hodgkin's lymphoma. The trial court completely failed to address the fact that the experts in this case rendered opinions that this particular claimant was a firefighter for a much longer period of time than the average firefighter discussed in the studies.

¶ 77. Second, Dr. Lockey and Dr. Guidotti looked at the fact that claimant was likely exposed to more toxins than the average firefighter, since claimant's firefighting career covered a time when protective equipment was often not used. Dr. Lockey noted that claimant was a firefighter "during a timeframe back in the '60s and '70s when control measures more likely than not were

not as good as they are currently.” Dr. Guidotti similarly noted that it was not until the 1970s that a self-contained protective breathing apparatus was widely introduced and that even then “relatively few” firefighters actually used such an apparatus. According to Dr. Guidotti, “there was a gap in the 1970s and the early ’80s when firefighters very often were not using their personal protection when fighting fires.”

¶ 78. Third, Dr. Guidotti also looked at the particular type of non-Hodgkin’s lymphoma that claimant contracted. Non-Hodgkin’s lymphoma does not refer to just one disease; rather, it is a large category that includes at least thirty recognized types of lymphoma. Dr. Guidotti noted that only some of those types “are known to be associated with environmental exposures and occupations.” Claimant had small cell lymphoma, which Dr. Guidotti noted is associated with environmental exposures. In particular, it is associated with exposure to solvents, including some of the same chemicals that are “released during firefighting.” Thus, Dr. Guidotti concluded that “the chemicals that are known to be associated with small cell lymphocytic lymphoma seem to be more than likely the kinds of things that one would encounter on the job.” This information was a significant factor leading Dr. Guidotti to state that, although “[s]cientific certainty in the matter is unattainable,” it was his opinion that the evidence favored the conclusion that claimant’s “lymphoma arose from work as a firefighter.”

¶ 79. Finally, both doctors also ruled out other possible causes of claimant’s disease before reaching their ultimate conclusions. Dr. Lockey examined claimant’s medical records and looked at whether there were “any other potential factors as it applies to [claimant] that would be known to be associated with a risk for the occurrence of non-Hodgkin’s lymphoma.” Dr. Lockey concluded that he “could not identify any other known risk factors based on the information that was available to me.”^[23] Dr. Lockey specifically noted that to his knowledge claimant “apparently did not have an immune deficiency disorder, which is the primary risk. As far as I was aware, he was not HIV positive, which would put him at risk for non-Hodgkin’s lymphoma.” This was a major factor leading Dr. Lockey to conclude “with a reasonable medical probability that [claimant’s] work as a firefighter was the cause of his non-Hodgkin’s lymphoma.” Dr. Guidotti also examined claimant’s medical records and similarly noted that this main risk factor could be ruled out for claimant, since a “severe immune problem . . . would have expressed itself by inability to work.” Because alternative explanations for contracting non-Hodgkin’s lymphoma were ruled out, the trial court should not have excluded the opinions concluding that it was more likely than not that claimant’s disease was caused by firefighting. See Daubert II, 43 F.3d at 1321 n.16; see also, e.g., Clapp & Ozonoff, supra, at 210 (“If it turns out that a particular individual plaintiff with a disease has few or none of these [alternative] risk factors, then a [relative risk] of 1.9 is a serious underestimate of the effects of his or her exposure.” (emphasis added)). Rather, the trial court should have recognized that this case presented the precise type of scenario that the Daubert II court noted could meet the admissibility threshold by combining studies with relative risks of less than 2.0 with other evidence:

[A] statistical study may show that a particular type of birth defect is associated with some unknown causes, as well as two known potential causes—e.g., smoking and drinking. If a study shows that the relative risk of injury for those who smoke is 1.5 as

compared to the general population, while it is 1.8 for those who drink, a plaintiff who does not drink might be able to reanalyze the data to show that the study of smoking did not account for the effect of drinking on the incidence of birth defects in the general population. By making the appropriate comparison—between non-drinkers who smoke and non-drinkers who do not smoke—the teetotaler plaintiff might be able to show that the relative risk of smoking for her is greater than two.

43 F.3d at 1321 n.16.

¶ 80. The trial court failed to recognize that both medical experts relied on numerous factors specific to claimant. The trial court stated that “Dr. Guidotti’s testimony in particular relies solely upon these [epidemiological] studies.” This was clear error. It was an abuse of discretion for the trial court to ignore all of the other factors relied upon by the experts in rendering their opinions. See, e.g., Foster v. Mydas Assocs., Inc., 943 F.2d 139, 143 (1st Cir. 1991) (“[A]buse of discretion occurs, of course, when a material factor deserving significant weight is ignored.” (quotation omitted)).

¶ 81. Courts have previously held that it is an “accepted methodology” to engage in an “analysis of medical literature and case study comparison with the individual characteristics of the patient’s case to determine” the cause of a disease. Cella v. United States, 998 F.2d 418, 426 (7th Cir. 1993). That is what Dr. Guidotti and Dr. Lockey did here. They looked at numerous epidemiological studies and then applied those studies to the particular facts they knew about claimant. In doing so, the doctors are free to rely on studies that fall below a relative risk of 2.0: “The physician or other such qualified expert may view the epidemiological studies and factor out other known risk factors . . . which might enhance the remaining recognized risks, even though the risk in the study fell short of the 2.0 correlation.” Grassis v. Johns-Manville Corp., 591 A.2d 671, 675 (N.J. Super. Ct. App. Div. 1991). The Grassis court chose not to adopt a 2.0 admissibility standard because “[t]he total basis for the expert’s opinion must be scrutinized.” Id. at 676.

¶ 82. The majority notes that the Baris study found that the level of excess risk of non-Hodgkin’s lymphoma “was not associated with an increased number of lifetime runs, and that, in fact, the standardized mortality ratio was highest in those individuals who made the lowest number of firefighting runs.” Ante, ¶ 33. There are three problems with the majority’s approach here: (1) it does not address any of the other factors particular to this claimant that the doctors relied upon in making their conclusions, such as claimant’s lack of protective safety equipment, lack of other known risk factors, and contraction of a type of non-Hodgkin’s lymphoma that is linked to solvents released during fires; (2) the majority’s questioning of the experts’ opinions is precisely the type of issue that goes to the weight of those opinions, not to their admissibility; and (3) the majority’s foray into interpretation of the Baris study is misleading and contrary to how the experts interpret that study.

¶ 83. The Baris study itself noted that “[s]mall numbers of observed deaths in the subcategories of the . . . cumulative runs analyses resulted in imprecise risk estimates.” Dr.

Guidotti noted that “Baris is very clear . . . that they don’t consider that the runs analysis was particularly useful.” Dr. Lockey, working with Dr. LeMasters, takes the same position and lists numerous possible alternative explanations, including “gross misclassification,” “a chance finding,” and “a healthy survivor effect.”^[24] At a minimum, these observations raise issues of disputed fact.

¶ 84. Dr. Guidotti and Dr. Lockey unsurprisingly found these alternative explanations more convincing than insurer’s counterintuitive claim (adopted by the majority today) that increased exposure to fires can decrease the likelihood of getting cancer. It is undisputed that firefighting exposes firefighters to known carcinogens: most of the studies presented to the trial court below state that as a given. For instance, the first sentence of the Baris study notes that “[f]irefighters are exposed under uncontrolled conditions to a wide variety of toxic chemicals including known and suspected carcinogens, such as benzene and formaldehyde in wood smoke, polycyclic aromatic hydrocarbons (PAHs) in soot and tars, arsenic in wood preservatives, asbestos in building insulation, diesel engine exhaust, and dioxins.” A carcinogen is defined as “a substance or agent producing or inciting cancer.” Webster’s New Collegiate Dictionary 165 (1981). Thus, it is difficult to understand why the majority puts any stock in the claim that increased exposure to carcinogens decreases one’s chance of cancer—a claim that is inherently self-contradictory, is called into question by the Baris study itself, and is resoundingly rejected by all three of claimant’s experts below.

¶ 85. The majority has to mention this strange finding from the Baris study because there is no other way to affirm the trial court’s decision. Dr. LeMasters, Dr. Lockey, and Dr. Guidotti all put much more stock in the Baris study’s finding that firefighters who are employed for more than twenty years are at a greater risk than other firefighters for contracting non-Hodgkin’s lymphoma. If those three experts are correct—or, rather, if a jury could conclude that they are correct—that increased exposure to fires leads to increased risk of non-Hodgkin’s lymphoma, claimant can argue that the generalized studies showing an association among firefighters underestimate the risk that he personally experienced. Then, even studies showing a relative risk of less than 2.0 help claimant make out a prima facie case that his forty years as a firefighter made it more likely than not that firefighting caused his disease.

¶ 86. The trial court recognized that “[t]he court in Daubert II even acknowledged that a study showing a ‘relative risk of less than two’ could be admissible, if ‘combined with other evidence to show it is more likely than not that the accused cause is responsible for a particular plaintiff’s injury.’ ” (quoting Daubert II, 43 F.3d at 1321 n.16). Here, the studies are combined with (among other things) the fact that it is more likely than not that claimant’s forty years as a firefighter put him at greater risk for contracting cancer than other firefighters. At the very least, claimant’s experts are entitled to an opportunity to make that argument to the jury, and it was an abuse of discretion for the trial court to rule summarily against claimants.

¶ 87. These facts could easily lead a reasonable jury to conclude that because claimant fought fires for forty years, he was exposed to more carcinogens—and was at greater risk for contracting non-Hodgkin’s lymphoma—than the average firefighter discussed in the epidemiological studies. Again, this comes back to this Court’s well-reasoned statement that “[t]he admitted evidence does not alone have to meet the proponent’s burden of proof on a

particular issue.” USGen, 2004 VT 90, ¶ 19. Here, the epidemiological studies can be combined with what was known about this particular claimant to make out a prima facie case that firefighting caused claimant’s cancer. Thus, the trial court abused its discretion when it excluded the proposed expert testimony.

III.

¶ 88. Although it is my view that adopting the 2.0 standard was a clear error of law here, even if that standard were acceptable the trial court abused its discretion by failing to provide any explanation as to why it excluded evidence based upon the Aronson, Figgs, and Sama studies—all three of which exceeded the 2.0 standard. Granted, the Aronson study could properly be excluded because its 2.04 relative risk finding was not statistically significant, as it had a confidence interval that included the number 1.0. But the trial court never explains that as a reason for excluding the Aronson study. More importantly, the Figgs and Sama studies could not be excluded as statistically insignificant, because both of these studies had confidence intervals entirely above 1.0. The Figgs study found a relative risk of 5.6, and the Sama found a relative risk of 3.27. Both of these studies were statistically significant and met the trial court’s strict 2.0 standard. Therefore, the court’s failure to explain why these studies were not themselves sufficient support for the opinion evidence constitutes an abuse of discretion that requires reversal. Joint Eastern, 52 F.3d at 1134 (reversing a trial court because it “did not specify its basis for disregarding” studies that met the court’s standard).

¶ 89. In this situation, the majority is wrong to conclude that there is “too great an analytical gap between the data and the opinion proffered.” Joiner, 522 U.S. at 146. Here there is no gap at all. The Figgs and Sama studies meet even the trial court’s strict 2.0 standard. Indeed, Joiner can be distinguished when the plaintiff has “several statistically significant epidemiological studies that . . . demonstrate[] an association” between the injury and its alleged cause. Giles v. Wyeth, Inc., 500 F. Supp. 2d 1048, 1061 (S.D. Ill. 2007). Here, claimant has presented two studies that are not only statistically significant, but that even meet the stringent 2.0 standard.

¶ 90. The trial court itself recognized that “two [of the studies] show a relative risk greater than 2.0—Figgs and Sama.” But the trial court appears to require some unspecified percentage (the majority? all?) of surveyed epidemiological studies to meet the 2.0 standard before the jury can even hear about any of the studies. Even Daubert II’s hard-line adoption of the 2.0 standard noted that in that case “[n]one of plaintiffs’ epidemiological experts claims that ingestion of Bendectin during pregnancy more than doubles the risk of birth defects.” 43 F.3d at 1320-21. By contrast, here there are two statistically significant studies that show a doubling of the risk. Yet the trial court never explains why that is not enough to send this issue to the jury.

¶ 91. Although the trial court found that the epidemiological studies “reflect widely varying degrees of relative risk,” that is not a reason to exclude all of the studies. Just because the studies had different results does not mean that they are all wrong, and claimant should be allowed to argue to the jury why the Figgs and Sama studies are the studies that arrived at the correct relative risk for claimant. That is particularly true here, where claimant’s experts found that although the relative risks were different, they for the most part all pointed in the same direction. As Dr. Lockey stated, there was “consistency across the medical literature based on

epidemiology studies of, in fact, a cause-effect relationship between this profession and the occurrence of non-Hodgkin's lymphoma.”

¶ 92. The trial court's unexplained dismissal of the Figgs and Sama studies is also problematic because it implies that the trial court improperly weighed these studies against other studies. Rule 702 “is not intended to authorize a trial court to exclude an expert's testimony on the ground that the court believes one version of the facts and not the other.” Advisory Committee Notes, F.R.E. 702. Numerous courts have come to the same conclusion. See, e.g., Heller v. Shaw Indus., 167 F.3d 146, 160 (3d Cir. 1999) (holding that expert testimony cannot be excluded simply because the expert uses one test rather than another, when both tests are accepted in the field and reach reliable results); Ruiz-Troche, 161 F.3d at 85 (“Daubert neither requires nor empowers trial courts to determine which of several competing scientific theories has the best provenance.”); Neurontin, 612 F. Supp. 2d at 150 (“That two key experts . . . vigorously disagree on the interpretation of the existing literature makes clear that Plaintiff's theory falls squarely within the range where experts might reasonably differ and is thus proper fodder for a jury.” (quotation omitted)).

IV.

¶ 93. In the final part of the trial court's opinion, it addressed the methodology of claimant's experts in producing a meta-analysis, and the court concluded that this methodology was not sound. Because the trial court has yet to engage in a proper analysis of this issue, we should remand this issue to the trial court to determine whether the meta-analysis meets the requirements of Daubert.

¶ 94. In the final two pages of the opinion below, the trial court openly disclosed the following instances of confusion regarding the proposed expert testimony: “it is unclear from Plaintiff's brief how [Dr. Guidotti] reached his opinion”; “[w]e do not know what scientific method he used”; “[t]his [study] apparently includes other types of cancers”; “Lockey and Masters apparently used a ‘weight-of-the-evidence’ approach”; “[it] is unclear whether Lockey and LeMasters' opinions in this case are based upon the meta-analysis.” (Emphases added.) Finally, the trial court concluded that although the meta-analysis conducted by Dr. Lockey and Dr. LeMasters “may be” a reliable scientific method, “we do not know which studies of which cancers were included in the meta-analysis,” and “we have no way of knowing whether it is based upon sufficient facts or data.” (Emphases added.)

¶ 95. But the trial court did have a way of knowing whether these expert studies were relevant and reliable: holding a Daubert hearing. The trial court never held a Daubert hearing.[\[25\]](#)

¶ 96. At the end of claimant's response to insurer's motion for summary judgment, claimant specifically “request[ed] a hearing pursuant to [Vermont Rule of Evidence] 104” if the trial court found one to be necessary. Although the trial court has a great deal of discretion in determining whether a hearing is necessary, here the court's own opinion recognizes its confusion on numerous critical issues, and it was therefore an abuse of discretion for the trial court to exclude the experts' testimony without holding a Daubert hearing or at least engaging in further analysis of the submitted materials.

¶ 97. Courts have noted that a trial court cannot exclude expert testimony without considering all of the data that the experts put forward in support of their conclusions:

Although the district court properly may exclude expert testimony if the court concludes too great an analytical gap exists between the existing data and the expert's conclusion, here the gap was of the district court's making. The court did not consider all of the data relied upon by Dr. Spindler, namely, studies by the defendant and others finding that Zyderm can induce autoimmune reactions. Consequently, the court abused its discretion in concluding that Dr. Spindler's testimony failed to meet Daubert's scientific knowledge requirement.

Kennedy, 161 F.3d at 1230; accord Jahn v. Equine Servs., PSC, 233 F.3d 382, 393 (6th Cir. 2000) (noting that although a trial court is not obligated to always hold a Daubert hearing, a "court should not make a Daubert ruling prematurely, but should only do so when the record is complete enough to measure the proffered testimony against the proper standards of reliability and relevance"); Paoli, 35 F.3d at 739 ("Given the 'liberal thrust' of the federal rules it is particularly important that the side trying to defend the admissibility of evidence be given an adequate chance to do so." (citing Daubert, 509 U.S. at 588)). Thus, in Padillas v. Stork-Gamco, Inc., 186 F.3d 412 (3d Cir. 1999), the court noted that although the decision to hold a Daubert hearing "rests in the sound discretion of the [trial] court," an abuse of discretion occurs when the trial court finds that the expert's opinion is "insufficiently explained," yet fails to hold a Daubert hearing to "giv[e] plaintiff an opportunity to respond to the court's concerns." Id. at 418.

¶ 98. Similarly, in USGen, we upheld the exclusion of evidence in part because the trial judge "heard from all three experts" before excluding evidence, 2004 VT 90, ¶ 1, and "rigorously reviewed all three experts' testimony, made detailed and extensive findings based on that review, and explained why he credited particular testimony above other testimony," id. ¶ 44. By contrast, here the trial court never heard any direct testimony from claimant's experts, and the court made numerous clear errors (such as stating that Dr. Guidotti "relie[d] solely upon epidemiology") that suggest that the court failed to engage in even a cursory review—let alone a rigorous one—of the materials that claimant submitted to the trial court. In this type of situation, as in Kennedy, it is fair to say that "[t]he court did not consider all of the data relied upon by" the experts, and any perceived analytical gap is "of the . . . court's making." 161 F.3d at 1230. This issue should therefore be remanded to the trial court for further analysis under Daubert.^[26]

¶ 99. In summary, the trial court abused its discretion in numerous ways by summarily excluding all of claimant's evidence and granting insurer's motion for summary judgment. Although some of claimant's studies can be excluded because they are statistically insignificant, and although a remand is needed to determine whether the meta-analysis is inadmissible, this does not justify excluding all of the proposed expert testimony.^[27] The trial court should have admitted the two medical doctors' expert testimony, which found specific causation based on four statistically significant studies (Burnett, Ma, Figgs, and Sama) and specific information about claimant. Two of those studies (Figgs and Sama) meet even the strict 2.0 relative risk standard and therefore directly support the experts' conclusions that it is more

likely than not that claimant’s injuries were caused by firefighting. The other two studies (Burnett and Ma) can be combined with specific information about claimant to bridge any “analytical gap between the data and the opinion proffered.” Joiner, 522 U.S. at 146. The trial court should have also admitted testimony from claimant’s epidemiologist to help explain the underlying studies and how firefighting can cause non-Hodgkin’s lymphoma.

¶ 100. In the end, this case is indistinguishable from Daewoo, where this Court found an abuse of discretion when a trial court “exclud[ed] expert testimony that met the standards articulated in Daubert and adopted by this Court.” Daewoo, 2008 VT 14, ¶ 16. Regardless of whether the conclusions of claimant’s experts are ultimately persuasive—an issue that is not before us today—“[t]he trial court should have allowed the adversarial process to draw out any deficiencies in the expert testimony, rather than usurping the jury’s function.” Id.

¶ 101. For these reasons, I would reverse and remand to the trial court to apply the proper legal standard for the admission of evidence. I therefore dissent.

¶ 102. I am authorized to state that Justice Johnson joins this dissent.

Chief Justice

[1] The appellant in this case is the Estate of Albert George, but for simplicity’s sake, we refer to appellant here as “claimant.”

[2] The Department of Labor apparently admits scientific evidence “if it is ‘plausible,’ leaving the ultimate weighing of that evidence to the finder of fact—first a hearing officer, then the Commissioner.”

[3] Claimant appears to have recognized this basic principle below. In response to insurer’s statement of undisputed material facts, claimant asserted that “[f]or purposes of this de novo trial, the findings and conclusions of the Department of Labor are wholly irrelevant.” Indeed, he asked that any reference to the Department’s conclusions “be stricken from the record.”

[4] We note that Vermont law now specifically provides that a firefighter who suffers disability or death from certain types of cancer is “presumed to have suffered the cancer as a result of exposure to conditions in the line of duty, unless it is shown by a preponderance of the evidence

that the cancer was caused by non-service-connected risk factors or non-service-connected exposure,” with certain limitations set forth by statute. 21 V.S.A. § 601(E).

[5] These studies and others are cited and collected within G. LeMasters et al., Cancer Risk Among Firefighters: A Review and Meta-analysis of 32 Studies, 48 J. Em. Med. 1189 (2006), available at <http://www.iaff.org/HS/PDF/Cancer%20Risk%20Among%20Firefighters%20-%20UC%20Study.pdf>.

[6] Green cautions, however, that “before an association or relative risk is used to make a statement about the probability of individual causation, the inferential judgment . . . that the association is truly causal rather than spurious is required: An agent cannot be considered to cause the illness of a specific person unless it is recognized as a cause of that disease in general.” Id. at 383-84 (quotation omitted).

[7] The Magistrini court explained this process in greater detail as follows:

Epidemiological studies attempt to identify agents that are associated with an increased risk of disease. Thus, the first question an epidemiologist asks is whether an association exists between exposure to an agent and a particular disease. An association between exposure to an agent and a disease exists when the two occur together more frequently than they would by mere chance. Once an association is observed, the scientist undertaking the study must assess the strength of the association as well as whether the reason for the observed association is due to bias, chance or real effect. . . .

Relative risk is commonly calculated by dividing the risk of developing a disease observed in an exposed group by the risk observed in an unexposed, but otherwise similar group. If the risks of the unexposed and exposed are the same, then the relative risk estimate (which mathematically is simply the former divided by the latter) is 1.0. This value is also called the null value, and indicates that exposure is not associated with the disease in that study. Thus, a relative risk of 1.0 means that the agent has no effect on the incidence of disease. Similarly, if the relative risk estimate is 1.3, then risk appears to be 30% higher among the exposed compared to the non-exposed. When the relative risk reaches 2.0, the risk has doubled, indicating that the risk is twice as high among the exposed group as compared to the non-exposed group. Thus, the threshold for concluding that an agent was more

likely than not the cause of an individual's disease is a relative risk greater than 2.0.

180 F. Supp. 2d at 591 (quotation omitted).

[8] As Dr. Guidotti noted, NHL “is a collection of widely disparate diseases that are not commonly separated in epidemiological studies.” He stated that NHLs consist of at least thirty recognized types, and he opined that new types will be identified as immunological and genomic methods become more sophisticated.

[9] The dissent concludes sua sponte that the court abused its discretion by failing to hold a Daubert hearing. No party raises this issue on appeal. In fact, the court did hold a hearing on the motion for summary judgment, and heard argument from both parties as to the admissibility of this evidence under Daubert and Rule 702. The parties also provided extensive written argument and evidence concerning the admissibility of claimant's expert testimony in their motions for summary judgment. The trial court had discretion in deciding whether an evidentiary hearing was necessary, and it acted within its discretion here. See, e.g., Nelson v. Tenn. Gas Pipeline Co., 243 F.3d 244, 249 (6th Cir. 2001) (reaching similar conclusion, and rejecting argument that trial court must hold evidentiary hearing to comply with Daubert, explaining that United States Supreme Court has made clear that decision whether to hold hearing falls within trial court's discretion).

[10] This appears to be a slight misstatement, as it appears that a relative risk of greater than 2.0 corresponds to a legal standard of “more likely than not.” See, e.g., Magistrini, 180 F. Supp. 2d at 591.

[11] As one court explains:

Association is a term of art in epidemiology. It is defined as “the degree of statistical dependence between two or more events or variables. Events are said to be associated when they occur more or less frequently together than one would expect by chance. Association does not necessarily imply a causal relationship. Events are said not to have an association when the agent (or independent variable) has no apparent effect on the incidence of a disease (the dependent variable).”

In re TMI Litig., 193 F.3d at 710 n.159 (quoting L. Bailey et al., Reference Guide on Epidemiology, in Reference Manual on Scientific Evidence 121, 171 (Federal Judicial Center ed., 1st ed. 1994)).

[12] A “confidence interval” is:

a range of values within which the results of a study sample would be likely to fall if the study were repeated numerous times. The width of the confidence interval provides an indication of the precision of the point estimate or relative risk found in the study; the narrower the confidence interval, the greater the confidence in the relative risk estimate found in the study. Where the confidence interval contains a relative risk of 1.0, the results of the study are not statistically significant.

In re TMI Litig., 193 F.3d at 711 n.165 (quoting Bailey, supra, at 173). We note that the Burnett study, cited by claimant in his brief as showing a relative risk of 1.32, does not appear to have been included in the printed case.

[13] There is no indication that the employer made a Daubert objection before the Hearing Officer that took the evidence for the Commissioner. Nor is there any indication whether the Commissioner would have recognized such an exception. In workers’ compensation proceedings, “process and procedure . . . shall be as summary and simple as reasonably may be.” 21 V.S.A. § 602. The Administrative Procedure Act statute on rules of evidence in administrative proceedings does not apply to workers’ compensation proceedings. See 3 V.S.A. §§ 810, 816(a)(3). As authorized by 21 V.S.A. § 602, the Commissioner has adopted rules specifying the procedure in workers’ compensation hearings. Rule 7.1000 of the Workers’ Compensation Rules provides: “The Vermont Rules of Civil Procedure and the Rules of Evidence as applied in Superior Court shall, in general, apply to all hearings conducted under 21 V.S.A. § 663, except as provided in these Rules, and only insofar as they do not defeat the informal nature of the hearing.” Workers’ Compensation and Occupational Disease Rule 7.1000, 3 Code of Vt. Rules 24 010 003-4, available at <http://labor.vermont.gov/portals/0/WP%20Safety/Rules%201-46%204%2006.pdf>.

[14] As noted by the majority, ante, ¶ 17 n.5, these studies and others are cited and collected within G. LeMasters et al., Cancer Risk Among Firefighters: A Review and Meta-analysis of 32 Studies, 48 J. Em. Med. 1189 (2006), available at <http://www.iaff.org/HS/PDF/Cancer%20Risk%20Among%20Firefighters%20-%20UC%20Study.pdf>.

[15] Dr. Lockey, for instance, is an occupational pulmonary physician and has “obtained thousands of occupational histories” in his practice and research. He is especially well qualified to combine his special knowledge of epidemiological patterns with a review of claimant’s particular occupational and medical history to form an opinion on whether firefighting caused claimant’s disease.

[16] The Vermont Legislature recently stated that when a firefighter dies from certain cancers—including lymphoma, which is the type of cancer that killed claimant—“the firefighter shall be presumed to have suffered the cancer as a result of exposure to conditions in the line of duty.” 2007, No. 42, § 2 (emphasis added). In adopting this presumption, the Legislature noted that around “28 states and the provinces of Canada have adopted legislation creating a presumption that certain cancers suffered by eligible firefighters are caused by exposure during their employment as firefighters.” *Id.* § 1(4). Although here claimant died before the passage of this legislative presumption, it is notable that many others agree with the views of claimant’s experts. Cf. *Ambrosini v. Labarraque*, 101 F.3d 129, 139 (D.C. Cir. 1996) (recognizing “additional indicia of reliability [that] support the admissibility of [the expert’s] testimony”).

[17] Indeed, the court even excluded studies that exceeded the 2.0 standard.

[18] Thus, the majority’s decision today does not preclude future trial courts from admitting evidence based on a more lenient standard than the 2.0 standard used by the trial court below.

[19] When the *Brock* court adopted its standard (requiring studies to have a confidence interval that does not include 1.0), the court noted that it viewed its decision as “encouraging district judges faced with medical and epidemiologic proof in subsequent toxic tort cases to be especially vigilant in scrutinizing the basis, reasoning, and statistical significance of studies presented by both sides.” *Id.* at 315, modified on reh’g, 884 F.2d at 167. In the case before the Court today, the majority affirms the trial court’s adoption of a standard that is much more stringent than what was adopted by the *Brock* court. Given that adopting the *Brock* standard is a way of being “especially vigilant in scrutinizing” expert evidence, *id.*, it is clear that here the trial court’s much more stringent standard goes too far, particularly in light of this Court’s holdings that we adopted *Daubert* to allow a more liberal standard for admitting evidence. See *State v. Tester*, 2009 VT 3, ¶ 18, 185 Vt. 241, 968 A.2d 895 (“*Daubert* intended a more liberal approach to the admission of expert evidence.”); *Daewoo*, 2008 VT 14, ¶ 9 (“We adopted the *Daubert* decision precisely because it comported with the ‘liberal thrust’ of the rules of evidence and broadened the types of expert opinion evidence that could be considered by the jury at trial.”).

[20] *Turpin*, like *Brock*, was also cited with approval by the United States Supreme Court in *Daubert*. See *Daubert*, 509 U.S. at 596.

[21] Indeed, several courts and commentators have stated that even the *Brock* standard requiring statistical significance is too stringent a test for admissibility. See, e.g., *Joint Eastern*, 52 F.3d at 1134; *Berry v. CSX Transp., Inc.*, 709 So. 2d 552, 570 (Fla. Dist. Ct. App. 1998) (“The use of ‘statistical significance’ to reject an epidemiological study has been roundly criticized by the

experts in the field.”); King, 762 N.W.2d at 47; Clapp & Ozonoff, supra, at 205 (“[P]rominent epidemiologists eschew ‘statistical significance,’ believing that it is not a sine qua non of good science and maintaining that it is neither necessary nor appropriate as a requirement for drawing inferences from epidemiologic data.”). That said, the more common position on this issue is that the Brock court was correct in stating that it is within a trial court’s discretion to exclude studies that do not show a statistically significant result. See Green, supra, at 359 n.73 (“A number of courts have followed the Brock decision or have indicated strong support for significance testing as a screening device.”).

[22] Several courts have held that epidemiological studies that meet the 2.0 standard are in themselves “sufficient to support an inference that an agent caused the particular plaintiff’s disease.” King, 762 N.W.2d at 46. Indeed, even defendant’s own brief cites a court’s holding that “[w]ith proper scientific interpretation, these correlations [found in epidemiological studies] provide an inference of causation.” Smith v. Ortho Pharm. Corp., 770 F. Supp. 1561, 1573 (N.D. Ga. 1991).

[23] Although neither of the doctors ever had a chance to personally examine claimant, this Court has previously stated that an expert need not have “firsthand” knowledge of something to make “conclusions [that] were not speculative but instead were ‘based on what is known.’” JAM Golf, 2008 VT 110, ¶ 10 (quoting Daubert, 509 U.S. at 590); cf. also Daewoo, 2008 VT 14, ¶ 14 (“[T]he fact that [the expert] did not himself visit the fire scene in conducting his investigation did not render insufficient the factual underpinnings of his opinion.”). Because experts need only focus on what is known, it is also no defense that claimant failed to produce details regarding specific exposures to specific known carcinogens while firefighting. As claimant noted during oral argument, claimant cannot be required to show a list of all of the carcinogens released during each fire he attended—information that even defendant concedes is simply not available. Further, to the extent that certain information is available, but experts fail to make use of it—for instance, if the doctors failed to engage more fully in the details of claimant’s medical history—this presents “an issue subject to cross-examination, but does not render [their] opinion[s] inadmissible under Rule 702.” Daewoo, 2008 VT 14, ¶ 12.

[24] The Baris study itself recognized that a “healthy survivor effect” can underestimate the true risk of exposure: “if there is a survivor effect in which the healthiest workers continued to be employed for a long term, using duration [of employment] as a proxy for exposure may mask a true relationship over the range of duration of employment.” For the same reason, a healthy survivor effect could underestimate the true risk of exposure when only the healthiest workers (those who are naturally less susceptible to contracting non-Hodgkin’s lymphoma) are able to make large numbers of lifetime runs.

[25] Although the majority claims that “[n]o party raises this issue on appeal,” ante, ¶ 25 n.9, the ultimate question on appeal is whether the trial court abused its discretion in dismissing evidence. This Court has previously noted that how “rigorously” a trial court reviewed proposed expert testimony is relevant to determining whether the trial court abused its discretion in dismissing that testimony. USGen, 2004 VT 90, ¶ 44.

[26] This does not necessarily mean that the trial court would need to hold a Daubert hearing on remand. Further analysis of the documents that have already been submitted could make it clear that the meta-analysis is either admissible or inadmissible. For instance, although the trial court noted that the meta-analysis is suspicious because it looks at studies involving related cancers in addition to non-Hodgkin's lymphoma, the court ignored the experts' explanation that such studies are in fact more reliable than narrower studies—an explanation that could tip the balance in favor of admissibility. Nevertheless, this should be left for the trial court to decide in the first instance after a more thorough analysis.

[27] For instance, as claimant told the trial court at oral argument, the meta-analysis "is not the only piece of the puzzle," but is rather "just one study" among many.