*Stanley Rochkind v. Starlena Stevenson*, No. 76, September Term, 2016, Opinion by Adkins, J.

**EXPERT WITNESS TESTIMONY — MARYLAND RULE 5-702 — SUFFICIENT FACTUAL BASIS:** An expert witness in a lead paint case did not have a sufficient factual basis to testify that lead exposure can cause Attention Deficit Hyperactivity Disorder ("ADHD") generally or that it caused the plaintiff's ADHD specifically. Although the expert relied on studies that recognize a causal link between lead exposure and general attention deficits and hyperactivity, she did not provide any support for her conclusion that lead can cause a clinical ADHD diagnosis. Thus, the trial court erred in admitting the expert testimony under Maryland Rule 5-702(3), and we remand for a new trial on the issue of damages. Because it would not affect the outcome of this case, we decline to reach Petitioner's argument that the trial court erred in failing to hold a *Frye-Reed* hearing on the expert's general causation testimony.

Circuit Court for Baltimore City
Case No.: 24-C-11-008722
Argued: April 3, 2017

IN THE COURT OF APPEALS

OF MARYLAND

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No. 76

September Term, 2016

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STANLEY ROCHKIND

v.

STARLENA STEVENSON

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Barbera, C.J.
Greene
Adkins
McDonald
Watts
Hotten
Getty,

JJ.

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Opinion by Adkins, J.

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Filed: July 11, 2017

We have often said that when it comes to expert testimony, trial court judges protect juries from "junk science" and other unsupported scientific conclusions. But in the complex field of behavioral disorders, the task of determining whether causation testimony rests on sound science is fraught with potential pitfalls. This case presents the question of whether studies concluding that lead exposure causes various attention problems constitute a sufficient factual basis for an expert's testimony that lead caused the plaintiff's Attention Deficit Hyperactivity Disorder ("ADHD").

## FACTS AND LEGAL PROCEEDINGS

Respondent Starlena Stevenson was born on December 22, 1990. For the first ten months of her life, Stevenson lived at 2110 Clifton Avenue in Baltimore City with her mother, Charlena Montgomery, and maternal grandmother, Lorena Cooks. In the fall of 1991, Stevenson and Montgomery moved to 3823 Fairview Avenue ("Fairview"), where they lived for 15 months. At the time, Fairview was owned in part by Petitioner Stanley Rochkind. According to Montgomery, Fairview contained chipping and flaking paint on the windowsills, floors, and front porch. Montgomery witnessed Stevenson mouthing the windows at Fairview. In early 1993, Stevenson and her mother moved to an apartment on Pennsylvania Avenue ("Pennsylvania").

In 1992 and 1993, Stevenson's blood lead level was tested three times. The results were as follows:

| Date | Age | Blood Lead Level[1] | Residence |
|---|---|---|---|
| October 29, 1992 | 1 year, 10 months | 14 µg/dL | Fairview |
| January 8, 1993 | 2 years | 13 µg/dL | Fairview |
| March 17, 1993 | 2 years, 3 months | 11 µg/dL | Pennsylvania |

When Stevenson was five years old, she was evaluated by Thomas Ley, Ph.D., a psychologist with the Kennedy Krieger Institute, because she was struggling to pay attention in school. Dr. Ley found that Stevenson's cognitive functioning was within the "low average to borderline range." He diagnosed Stevenson with ADHD and recommended that she begin taking medication to treat it. Over the next few years, Stevenson was prescribed Dexedrine, Ritalin, and Adderall to treat her ADHD. In 2004, when she was thirteen years old, Stevenson attempted suicide by cutting her wrists and overdosing on prescription medication. The following year, Stevenson complained of auditory hallucinations and depression. She was evaluated by a psychologist at Mount Washington Pediatric Hospital ("MWPH") who diagnosed her with major depressive disorder and generalized anxiety disorder.

Since graduating from high school in 2008, Stevenson has been sporadically employed. She has worked as a patient transporter for the University of Maryland Medical System ("UMMS"), a cashier for Royal Farms, and a babysitter. Stevenson was fired from her job at UMMS, and she testified that she quit her job at Royal Farms because she was bored. As of October 2014, Stevenson was unemployed.

[1] Blood lead is measured in micrograms per deciliter ("µg/dL").

In December 2011, Stevenson filed suit against Rochkind in the Circuit Court for Baltimore City for negligence and violations of the Maryland Consumer Protection Act.[2] In July 2012, Arc Environmental, Inc. conducted lead testing at Fairview. The testing detected lead-based paint on 22 interior surfaces and nine exterior surfaces. In February 2013, Cecilia Hall-Carrington, M.D., a pediatrician, filed a report concluding to "a reasonable degree of medical probability" that Stevenson was poisoned by lead at Fairview, and that "her lead poisoning is a significant contributing factor" to her neuropsychological problems, including her ADHD.

Before trial, Rochkind filed four motions *in limine* seeking to exclude Dr. Hall-Carrington's testimony. He argued that she should not be permitted to testify that Fairview was a source of Stevenson's lead exposure or that such exposure caused Stevenson's "cognitive deficits," including, specifically, ADHD. Rochkind requested a *Frye-Reed* hearing on each motion. The court denied his request. After hearing arguments on the motions *in limine*, the court denied them as well. The jury returned a verdict in favor of Stevenson, awarding her $829,000 in economic damages and $534,000 in noneconomic damages. Rochkind filed a motion for a new trial, or, in the alternative, a remittitur. The court granted his motion in part and ordered a new trial on the issue of damages alone.

The partial new trial began in October 2014. Before trial, Rochkind renewed his motions *in limine* to exclude Dr. Hall-Carrington's ADHD testimony, which were again

[2] Stevenson also filed suit against S&S Partnership, a co-owner of 3823 Fairview Avenue ("Fairview") while Stevenson lived there, and Dear Management & Construction Company, which managed Fairview at the time. Neither party is involved in this appeal.

denied. The court declined to hold a *Frye-Reed* hearing, explaining that Dr. Hall-Carrington's opinions are "not new science" or "new conclusions." It admitted her testimony under Maryland Rule 5-702 because it found that she drew from "reliable sources."

During trial, Dr. Hall-Carrington testified as to both general and specific ADHD causation. She explained that studies show that lead exposure can cause "attention problems[ ] or ADHD" generally. She also opined "within a reasonable degree of medical probability" that lead exposure caused Stevenson's ADHD specifically. To support her testimony, Dr. Hall-Carrington relied on a publication from the Environmental Protection Agency reviewing the most recent studies on the effects of lead exposure in children, titled "Integrated Science Assessment for Lead" ("the EPA-ISA"). She testified that the EPA-ISA concluded that there is a causal relationship between lead exposure and the symptoms of ADHD, such as attention decrements, impulsivity, and hyperactivity. Dr. Hall-Carrington also testified that "some years ago there was a concern with suicide in kids [taking] Adderall." In closing argument, Stevenson's counsel implied that Stevenson's depression and hallucinations were side effects of her ADHD medications, including Adderall.

The jury awarded Stevenson $753,000 in economic damages and $700,000 in noneconomic damages. Due to the statutory cap on noneconomic damages, the court reduced the total judgment to $1,103,000. *See* Md. Code (1986, 2013 Repl. Vol.), § 11-108 of the Courts and Judicial Proceedings Article. Rochkind filed a motion for a new trial, which the court denied. He filed a timely appeal.

The Court of Special Appeals held that the trial court did not err in failing to hold a *Frye-Reed* hearing on Dr. Hall-Carrington's general causation testimony because the studies she relied upon did not reach novel conclusions and "used methodologies that are generally accepted" in the scientific community. *Rochkind v. Stevenson*, 229 Md. App. 422, 464 (2016). The intermediate appellate court also held that the trial court properly admitted Dr. Hall-Carrington's specific causation testimony under Rule 5-702 because her opinion "was supported by an adequate factual basis and was sufficient to allow the jury to decide the causal connection, if any, between lead exposure and [ ] Stevenson's ADHD." *Id.* at 465. Rochkind appealed.

We granted *certiorari* to answer the following questions:[3]

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[3] We have consolidated and rephrased the questions presented. Petitioner Stanley Rochkind presented the following questions in his Petition for Writ of Certiorari:

> 1. Did the CSA err when it determined under *Frye-Reed* that it is "generally accepted" that lead exposure causes ADHD (general causation), despite the fact that every major medical organization in the country concludes that the cause of ADHD is "unknown," but overwhelmingly suspects ADHD is caused by heredity?
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> 2. Did the CSA err by conducting its *own*, non-adversarial *Frye-Reed* analysis on whether lead exposure causes ADHD rather than remanding to the Circuit Court for an adversarial evidentiary hearing, which would have demonstrated that the EPA publication upon which the CSA exclusively relied is (i) controversial, (ii) subject to heavy criticism, and (iii) not accepted in the medical community?
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> 3. Did the CSA err when it failed to apply the "reliable methodology" requirement of Rule 5-702 to Dr. Hall-

1. Did the trial court err in admitting Dr. Hall-Carrington's general and specific ADHD causation testimony under Maryland Rule 5-702?

2. Did the trial court err in failing to hold a *Frye-Reed* hearing on Dr. Hall-Carrington's general ADHD causation testimony?

Because we answer the first question in the affirmative, we reverse the decision of the Court of Special Appeals and remand for a new trial on the issue of damages. Therefore, we do not reach the second question.

## STANDARD OF REVIEW

Rochkind challenges the trial court's decision to admit Dr. Hall-Carrington's expert testimony on the causal relationship between lead exposure and ADHD. "[T]he admissibility of expert testimony is a matter largely within the discretion of the trial court." *Bryant v. State*, 393 Md. 196, 203 (2006) (citations and internal quotation marks omitted). Thus, we review a trial court's decision to admit or exclude expert testimony only for an abuse of discretion. *Rollins v. State*, 392 Md. 455, 499–500 (2006). "Such a ruling, however, may be reversed on appeal if it is founded on an error of law or some serious mistake, or if the trial court clearly abused its discretion." *Sippio v. State*, 350 Md. 633, 648 (1998) (citation and internal quotation marks omitted). Additionally, we will not affirm a decision within the discretion of the trial court if the judge acts in an "arbitrary or capricious manner" or "beyond the letter or reason of the law." *Garg v. Garg*, 393 Md. 225, 238 (2006) (citation omitted).

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Carrington's opinion that lead exposure "caused" Stevenson's ADHD (specific causation)?

## DISCUSSION

Rochkind argues that Dr. Hall-Carrington's testimony should have been excluded because it failed to meet the requirements of both Maryland Rule 5-702 and our *Frye-Reed* standard for testimony based on a novel scientific theory. Rule 5-702 governs the admissibility of all expert testimony. *Reed v. State*, 283 Md. 374 (1978), which adopted the standard set forth by the U.S. Court of Appeals for the D.C. Circuit in *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923), added an additional requirement for expert testimony based on a novel scientific method. Under *Frye-Reed*, a trial court must determine whether a novel scientific method is generally accepted within the relevant scientific community before testimony based on that method can be admitted. *Reed*, 283 Md. at 381. Stevenson contends that Dr. Hall-Carrington's testimony was properly admitted because it clears both hurdles. We begin with Rule 5-702.

### Maryland Rule 5-702

To determine whether expert testimony "will assist the trier of fact to understand the evidence or to determine a fact in issue," Rule 5-702 directs a trial court to evaluate "(1) whether the witness is qualified as an expert by knowledge, skill, experience, training, or education[;] (2) the appropriateness of the expert testimony on the particular subject[;] and (3) whether a sufficient factual basis exists to support the expert testimony." The burden rests with the proponent of the expert testimony to demonstrate that these requirements have been met. *Bomas v. State*, 412 Md. 392, 417–18 (2010).

We have interpreted the third prong of this analysis—sufficient factual basis—to include two subfactors: an adequate supply of data and a reliable methodology. *Roy v.*

*Dackman*, 445 Md. 23, 42–43 (2015) (citation omitted); *see also Exxon Mobil Corp. v. Ford*, 433 Md. 426, 478 (2013). To constitute "more than mere speculation or conjecture," the expert's opinion must be based on facts sufficient to "indicate the use of reliable principles and methodology in support of the expert's conclusions." *Ford*, 433 Md. at 478 (citation and internal quotation marks omitted). To demonstrate a sufficient factual basis, an expert must establish that her testimony is supported by both subfactors.

The data supporting an expert's testimony "may arise from a number of sources, such as facts obtained from the expert's first-hand knowledge, facts obtained from the testimony of others, and facts related to an expert through the use of hypothetical questions." *Sippio*, 350 Md. at 653 (citation omitted). The facts or data that form the basis of the expert's opinion may be "perceived by or made known to the expert at or before the hearing." Md. Rule 5-703(a). If the materials the expert relies upon are "of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject," they do not need to be admissible in evidence. *Id.*

In addition to drawing from an adequate supply of data, an expert must use a reliable methodology to reach her conclusions. *Exxon Mobil Corp. v. Albright*, 433 Md. 303, 418–19 (2013) (citation omitted). To satisfy this prong, "an expert opinion must provide a sound reasoning process for inducing its conclusion from the factual data and must have an adequate theory or rational explanation of how the factual data led to the expert's conclusion." *Ford*, 433 Md. at 481 (citation and internal quotation marks omitted). We have explained that "for an opinion to assist a trier of fact, the trier of fact must be able to evaluate the reasoning underlying that opinion." *Ross v. Hous. Auth. of Balt. City*, 430 Md.

648, 663 (2013). Thus, conclusory statements of opinion are not sufficient—the expert must be able to articulate a reliable methodology for how she reached her conclusion. *Ford*, 433 Md. at 481–82 (citation omitted).

Rochkind argues that Dr. Hall-Carrington's specific causation testimony does not satisfy Rule 5-702(3) because she did not rule out other potential causes of Stevenson's ADHD or otherwise demonstrate a reliable methodology for her opinion.[4] Rochkind contends that in lieu of a differential diagnosis, Dr. Hall-Carrington was required to cite epidemiological studies that found a causal link between lead and ADHD. Stevenson responds that Dr. Hall-Carrington's testimony satisfies Rule 5-702(3) because the studies she relied upon provide extensive support for the conclusion that lead can cause attention deficits in children.

*Adequate Supply of Data*

To support her testimony that lead exposure can cause ADHD, Dr. Hall-Carrington relied on the EPA-ISA paper, which explains that "multiple, high quality epidemiologic studies" have revealed "a causal relationship between [lead] exposure and attention decrements, impulsivity, and hyperactivity in children." U.S. Envtl. Prot. Agency,

[4] Rochkind does not argue that Dr. Hall-Carrington's general causation testimony fails to satisfy Rule 5-702—he urges us to exclude that testimony under *Frye-Reed*. But both general and specific causation testimony are subject to Rule 5-702, and Dr. Hall-Carrington's specific causation testimony relies on the admissibility of her general causation testimony. If she cannot testify that lead exposure can cause ADHD, she cannot testify that lead exposure caused Stevenson's ADHD. *See In re Mirena IUD Prods. Liab. Litig.*, 169 F. Supp. 3d 396, 436 (S.D.N.Y. 2016) ("[B]ecause I have found that [the expert's] general causation opinion is not based on a reliable methodology and is therefore inadmissible, his specific causation [opinion] must also be excluded."). Thus, we begin with an analysis of Dr. Hall-Carrington's general causation testimony under Rule 5-702.

EPA/600/R-10/075F, Integrated Science Assessment for Lead 4-314 tbl. 4-17, 4-289 (2013) [hereinafter EPA-ISA], https://www.epa.gov/isa/integrated-science-assessment-isa-lead (follow "PDF" hyperlink) [https://perma.cc/ECQ7-TFWS]. During the second trial, Dr. Hall-Carrington testified that these studies found that children with blood lead levels similar to Stevenson's "can have attention problems, or ADHD, as well as learning disabilities." When asked if this portion of the EPA-ISA mentions ADHD specifically, she testified, "No, it doesn't." She continued, "It basically is listing the symptoms, so to speak, of ADHD." As to Stevenson's ADHD specifically, Dr. Hall-Carrington testified that it was caused by her exposure to lead.

We have yet to decide the extent to which epidemiological studies can support expert testimony on causation. Thus, we look to other jurisdictions for guidance. In *General Electric Co. v. Joiner*, 522 U.S. 136 (1997), the U.S. Supreme Court evaluated expert testimony relying on epidemiological studies for the conclusion that polychlorinated biphenyls ("PCB's") can cause lung cancer.[5] *Id.* at 145–46. The Court held that the studies

[5] *General Electric Co. v. Joiner*, 522 U.S. 136 (1997), was decided three years before the Federal Rules of Evidence ("FRE") were amended to include language requiring expert testimony to be based on "sufficient facts or data." The Advisory Committee's Note explains, however, that the amendment was made in response to *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), and its progeny, including *Joiner*. Fed. R. Evid. 702 advisory committee's note. In *Daubert*, the U.S. Supreme Court held that FRE 702 required trial courts to evaluate "whether the reasoning or methodology underlying the testimony is scientifically valid and [ ] whether that reasoning or methodology properly can be applied to the facts in issue." *Daubert*, 509 U.S. at 592–93.

The FRE were restyled in 2011 without substantive change. FRE 702 now provides:

could not support the expert testimony because none of them had found **a causal link** between PCB's and cancer. *Id.* As to one study that noted that lung cancer deaths among former employees of an electrical plant were higher than expected, the Court explained that "[g]iven that [the researchers] were unwilling to say that PCB exposure had caused cancer among the workers they examined, their study did not support the experts' conclusion that Joiner's exposure to PCB's caused his cancer." *Id.* at 145. The Court explained that "nothing in . . . the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." *Id.* at 146. Rather, the Court reasoned, a "court may conclude that there is simply too great an analytical gap between the data and the opinion proffered." *Id.*; *see also Blackwell v. Wyeth*, 408 Md. 575, 606–10 (2009) (evaluating whether expert testimony suffered from "analytical gap" under our *Frye-Reed* framework); *Mitchell v. Gencorp Inc.*, 165 F.3d 778, 782–83 (10th Cir. 1999) (holding that expert testimony suffered from "an analytical gap" when studies only supported a connection between the chemical agent and the plaintiff's leukemia, not a causal relationship (quoting *Joiner*, 552 U.S. at 146)).

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

Dr. Hall-Carrington did not provide a sufficient factual foundation for why she thought the EPA-ISA supported her conclusion that lead exposure can cause ADHD. The studies described in the EPA-ISA finding a causal relationship between lead exposure and attention deficits and hyperactivity do not go that far. The American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* ("the *DSM-V*") lists several criteria for an ADHD diagnosis, including that the patient exhibit a minimum number of specific symptoms "for at least [six] months to a degree that is inconsistent with [the patient's] developmental level and that negatively impacts directly on [the patient's] social and academic/occupational activities."[6] Am. Psychiatric Ass'n, *Diagnostic and Statistical Manual of Mental Disorders* 59 (5th ed. 2013) [hereinafter *DSM-V*]. Dr. Hall-Carrington did not provide any information on this diagnostic criteria or otherwise differentiate between general attention deficits and a clinical ADHD diagnosis.

Although research shows that lead exposure can cause general attention deficits and hyperactivity, these lead-caused behaviors do not necessarily indicate that an individual has ADHD because these behaviors are also symptoms of a variety of other disorders and learning disabilities. *See id.* at 63–65; Nat'l Inst. of Mental Health, Attention-

[6] The American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* ("the *DSM-V*") breaks the symptoms of ADHD into two categories: (1) inattention; and (2) hyperactivity and impulsivity. Am. Psychiatric Ass'n, *Diagnostic and Statistical Manual of Mental Disorders* 59, 60 (5th ed. 2013) [hereinafter *DSM-V*]. The inattention symptoms include often failing "to give close attention to details," "difficulty sustaining attention," and reluctance "to engage in tasks that require sustained mental effort." *Id.* at 59. The hyperactivity and impulsivity symptoms include "fidget[ing] with or tap[ping] hands or feet," inability "to play or engage in leisure activities quietly," and "difficulty waiting his or her turn." *Id.* at 60.

Deficit/Hyperactivity Disorder (ADHD): The Basics, https://www.nimh.nih.gov/health/publications/attention-deficit-hyperactivity-disorder-adhd-the-basics/index.shtml (follow "Download PDF" hyperlink) [https://perma.cc/89RV-AGRQ]; *Guckenberger v. Boston Univ.*, 974 F. Supp. 106, 131 (D. Mass. 1997). Indeed, the *DSM-V* instructs clinicians to rule out several other behavioral disorders with similar symptoms before diagnosing a child with ADHD. *DSM-V* at 63–65. Clearly, general attention deficits and ADHD are not one and the same.

The jump from attention deficits and hyperactivity to a clinical ADHD diagnosis may seem reasonable, but we have explained that "just because a conclusion is reasonable does not mean that a court must permit an expert to make it." *Ross*, 430 Md. at 664. Because of the added weight a jury might give to testimony from a designated expert, the trial court "ought to insist that a proffered expert bring to the jury more than the lawyers can offer in argument." *Id.* (citation omitted). In equating attention deficits and hyperactivity with a clinical ADHD diagnosis, Dr. Hall-Carrington painted an inaccurate picture of the scientific research regarding lead poisoning—she overstated the known effects of lead exposure. Her testimony suffers from the same "analytical gap" described in *Joiner*.

To be sure, the EPA-ISA includes discussion of studies exploring the relationship between lead exposure and ADHD specifically,[7] but these cannot bolster Dr. Hall-

[7] During the damages trial, one of Rochkind's expert witnesses acknowledged that "at least some of the literature suggests that ADHD can be caused by lead." He opined, however, that Stevenson's blood lead levels were not high enough to have caused her ADHD. This testimony does not prevent Rochkind from arguing that Dr. Hall-

Carrington's opinion because they only reveal **an association** between lead exposure and ADHD. The EPA-ISA explains that an association—a statistical relationship between two variables—"is insufficient proof of a causal relationship between an exposure and a health outcome." EPA-ISA at li. The Supreme Court of West Virginia has explained that determining the "soundness of an epidemiological study and its [usefulness] in resolving causation" requires evaluating whether the study reveals a causal relationship between the chemical agent and the disease. *Harris v. CSX Transp., Inc*., 753 S.E.2d 275, 282 (W.Va. 2013) (citing Michael D. Green et al., *Reference Guide on Epidemiology*, *in* Reference Manual on Scientific Evidence 549, 553 (3d ed. 2011)). Similarly, the U.S. District Court for the Eastern District of Washington has explained that epidemiological studies are "probative of general causation" when "the study properly accounts for potential confounding factors and concludes that exposure to the agent is what increases the probability of contracting the disease." *Henricksen v. ConocoPhillips Co.*, 605 F. Supp. 2d 1142, 1158 (E.D. Wash. 2009) (emphasis omitted) (citation omitted). The ADHD studies summarized in the EPA-ISA do not meet this standard.

Indeed, the EPA-ISA explains that in declaring a causal relationship between lead exposure and attention deficits, impulsivity, and hyperactivity, studies finding a lead-associated increase in ADHD were "not a major consideration" because of "inconsistent consideration for potential confounding by factors such as [socioeconomic status], parental

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Carrington's causation testimony should have been excluded. We have explained that a "defendant does not waive an error by attempting to minimize or explain improperly admitted evidence." *State v. Logan*, 394 Md. 378, 390 (2006) (citation omitted).

education, or parental caregiving quality." EPA-ISA at 4-289–90. The EPA-ISA also notes that ADHD is "considered to have a strong familial component" and that studies revealing an association between lead exposure and ADHD have been critiqued for failing to take parental history of ADHD into account. *Id.* at 4-151 (citations omitted). Thus, without accounting for potential confounding factors, including family history of ADHD, these epidemiological studies cannot support Dr. Hall-Carrington's general causation testimony.[8] *See Henricksen*, 605 F. Supp. 2d at 1158 (citation omitted).

Apart from the EPA-ISA, Dr. Hall-Carrington did not cite to any other studies to support her opinion that lead exposure can cause ADHD.[9] Without scientific evidence, Dr.

[8] Despite extensive study, the cause of ADHD is largely unknown. J. Tarver et al., *Attention Deficit Hyperactivity Disorder (ADHD): An Updated Review of the Essential Facts*, 40 Child: Care, Health & Dev. 762, 762 (2014); *Facts About ADHD*, Ctrs. for Disease Control & Prevention, http://www.cdc.gov/ncbddd/adhd/facts.html (last updated Nov. 16, 2016) [https://perma.cc/9DDZ-BKMJ]; *Attention Deficit Hyperactivity Disorder*, Nat'l Inst. of Mental Health, https://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd/index.shtml (last revised Mar. 2016) [https://perma.cc/GBK5-KKCL]; *Causes of ADHD: What We Know Today*, Am. Acad. of Pediatrics, https://www.healthychildren.org/English/health-issues/conditions/adhd/Pages/Causes-of-ADHD.aspx (last updated Jan. 9, 2017) [https://perma.cc/5TAD-M7HQ]. The Centers for Disease Control and Prevention and the National Institute of Mental Health both list lead and other environmental toxins as a "risk factor" for ADHD, but neither institution reports that a causal link has been demonstrated. *Facts About ADHD*, Ctrs. for Disease Control and Prevention, *supra*; *Attention Deficit Hyperactivity Disorder*, Nat'l Inst. of Mental Health, *supra*. The *DSM-V* explains that "[e]xposure to environmental toxicants has been correlated with subsequent ADHD, but it is not known whether these associations are causal." *DSM-V* at 62.

[9] Stevenson presented a number of other publications summarizing the relevant medical literature to the trial court in response to Rochkind's motion to exclude Dr. Hall-Carrington's testimony. But none of those reports describe studies that found causal link between lead exposure and ADHD. Rather, like the EPA-ISA, they describe a connection between lead exposure and general attention problems. *See* Robert Kliegman et al., Nelson Textbook of Pediatrics 2914 (18th ed. 2007) ("Hyperactivity is noted in young school age

Hall-Carrington cannot be permitted to testify that such a causal connection exists generally, or that lead exposure caused Stevenson's ADHD specifically.[10] *See Bomas*, 412 Md. at 420 (holding expert testimony on eyewitness identification properly excluded when the "witness offered nothing to support his general statements"). As the U.S. District Court for the Northern District of Oklahoma explained when faced with the same question before us, "[e]ven if [the expert] believes this link exists, without scientific support and research cited in her expert report and deposition this opinion is classic *ipse dixit*, and any testimony

children with histories of lead poisoning or with concurrent elevations in [blood lead level]."); Comm. on Envtl. Health, Am. Acad. of Pediatrics, *Policy Statement, Lead Exposure in Children: Prevention, Detection, and Management*, 116 Pediatrics 1036, 1038 (2005) ("Elevated bone lead concentrations are associated with increased attentional dysfunction, aggression, and delinquency." (footnote omitted)); U.S. Dep't of Housing & Urban Dev., *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* 1-5 (2d ed. 2012) (warning that lead poisoning can cause "reductions in IQ and attention span, reading and learning disabilities, hyperactivity, and behavioral problems"). One article describes "increased rates of attention-deficit hyperactivity disorder" as a "permanent effect[ ] of lead poisoning," but its authors do not cite to any studies to support this proposition. Gabriel M. Filippelli & Mark A.S. Laidlaw, *The Elephant in the Playground: Confronting Lead-Contaminated Soils as an Important Source of Lead Burdens to Urban Populations*, 53 Persps. in Biology Med. 31, 33 (2010).

[10] We do not mean to suggest that an expert witness must detail the scientific studies she relied on before stating her opinion. Under Maryland Rule 5-705 an "expert may testify in terms of opinion or inference and give reasons therefor without first testifying to the underlying facts or data." But when the opposing party has objected to the testimony under Rule 5-702(3), the expert must indicate the factual basis for her opinion. *See Bomas v. State*, 412 Md. 392, 420–21 (2010) (holding that the expert lacked a sufficient factual basis because "the record is devoid of any specific study whose data [he] relied on to form his opinion on this issue").

that lead exposure caused ADHD will be excluded." *Palmer v. Asarco Inc.*, 510 F. Supp. 2d 519, 531 (N.D. Okla. 2007).[11]

Without epidemiological studies—or other reliable evidence—demonstrating a causal link between lead exposure and ADHD, Dr. Hall-Carrington's testimony "amounted to no more than mere speculation and conjecture." *Bentley v. Carroll*, 355 Md. 312, 338 (1999). Thus, Stevenson failed to carry her burden of demonstrating that Dr. Hall-Carrington had an adequate supply of data to support her general causation testimony. Accordingly, her testimony is not admissible under Rule 5-702(3). We do not reach the question of whether Dr. Hall-Carrington utilized a reliable methodology to formulate her testimony.

In sum, the trial court failed to determine whether Stevenson's proffered sources logically supported Dr. Hall-Carrington's opinion that lead exposure can cause ADHD. In other words, it failed to check for an "analytical gap" between the expert's data and her conclusion. Because we find that the trial court clearly erred in this respect, we hold that it abused its discretion in admitting the expert testimony.[12] *See Roy*, 445 Md. at 40

[11] Stevenson argues that Dr. Hall-Carrington had a sufficient factual basis for her causation testimony because she only opined that lead exposure was a significant contributing factor to Stevenson's ADHD—not the sole cause. But the conclusion that lead was a substantial contributing factor to an injury still requires a causal connection. Without relying on any medical studies documenting a causal link between lead exposure and ADHD, Dr. Hall-Carrington cannot testify that lead exposure caused Stevenson's ADHD, even in part.

[12] Generally, the burden "in civil cases is on the appealing party to show that an error caused prejudice." *Barksdale v. Wilkowsky*, 419 Md. 649, 660 (2011). During oral argument, Rochkind asserted, through counsel, that Stevenson's ADHD was "the hallmark" of her case. The record shows that the injuries Stevenson sustained due to her

(reversing the trial court's decision to exclude expert testimony because it constituted "a clear abuse of discretion"); *Albright*, 433 Md. at 424 ("Because the trial court's admission of [the expert] testimony was clear error, we . . . direct remand for a new trial.").

### *Frye-Reed* Analysis

Rochkind argues that the trial court should have held a *Frye-Reed* hearing as to Dr. Hall-Carrington's general causation testimony because the existence of a causal link between lead exposure and ADHD is novel, and it is not generally accepted in the scientific community. Because we conclude that all of Dr. Hall-Carrington's ADHD causation testimony should have been excluded under Rule 5-702, we decline to reach this issue.

## CONCLUSION

Dr. Hall-Carrington did not have a sufficient factual basis for her testimony as required by Rule 5-702(3). Thus, the trial court abused its discretion in permitting her to opine that lead exposure can cause ADHD generally and that lead caused Stevenson's ADHD specifically. Accordingly, we remand for the circuit court to hold a new trial on the issue of damages.

**JUDGMENT OF THE COURT OF SPECIAL APPEALS REVERSED. CASE REMANDED TO THAT COURT FOR THE ENTRY OF AN ORDER VACATING THE JUDGMENT OF THE CIRCUIT COURT FOR BALTIMORE**

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ADHD and the side effects of her ADHD medication were a significant aspect of the trial, which was limited to damages. Dr. Hall-Carrington's testimony explicitly connected Stevenson's lead exposure to her ADHD and indirectly to the side effects of her ADHD medication. Stevenson does not argue that the trial court's decision to admit the testimony did not prejudice Rochkind. After a full review of the record, we conclude that Dr. Hall-Carrington's testimony was unduly prejudicial.

**CITY AND REMANDING THE CASE TO THE CIRCUIT COURT FOR BALTIMORE CITY FOR A NEW TRIAL ON THE ISSUE OF DAMAGES. COSTS TO BE PAID BY RESPONDENT.**