RECORD IMPOUNDED

NOT FOR PUBLICATION WITHOUT THE
APPROVAL OF THE APPELLATE DIVISION

SUPERIOR COURT OF NEW JERSEY
APPELLATE DIVISION
DOCKET NO. A-2069-21
A-2936-21

STATE OF NEW JERSEY,

Plaintiff-Appellant,

v.

DARRYL NIEVES,

Defendant-Respondent.

APPROVED FOR PUBLICATION

September 13, 2023

APPELLATE DIVISION

———————————————

STATE OF NEW JERSEY,

Plaintiff-Appellant,

v.

MICHAEL CIFELLI,

Defendant-Respondent.

———————————————

Argued May 15, 2023 – Decided September 13, 2023.

Before Judges Gooden Brown, DeAlmeida and Mitterhoff.

On appeal from the Superior Court of New Jersey, Law Division, Middlesex County, Indictment No. 17-06-0785 and an interlocutory order of the Superior Court of New Jersey, Law Division, Middlesex County, Indictment No. 17-11-1303.

David M. Liston, Assistant Prosecutor, argued the cause for appellant (Yolanda Ciccone, Middlesex County Prosecutor, attorney; David M. Liston, of counsel and on the briefs).

Cody Tyler Mason, Deputy Public Defender, argued the cause for respondent Darryl Nieves (Joseph E. Krakora, Public Defender, attorney; Cody Tyler Mason, of counsel and on the brief).

Philip Nettl argued the cause for respondent Michael Cifelli (Benedict and Altman, attorneys; Joseph Benedict and Philip Nettl, on the brief).

Carter E. Greenbaum (Paul, Weiss, Rifkind, Wharton & Garrison LLP) of the New York and California bars, admitted pro hac vice, argued the cause for amicus curiae Medical Physicians (Steven C. Herzog (Paul, Weiss, Rifkind, Wharton & Garrison LLP), Carter E. Greenbaum, Tania Brief (Innocence Project, Inc.) of the New York bar, admitted pro hac vice, Audra J. Soloway (Paul, Weiss, Rifkind, Wharton & Garrison LLP) of the New York bar, admitted pro hac vice, David Cole (Paul, Weiss, Rifkind, Wharton & Garrison LLP) of the District of Columbia and Massachusetts bars, admitted pro hac vice, Robyn Bernstein (Paul, Weiss, Rifkind, Wharton & Garrison LLP) of the New York bar, admitted pro hac vice, and Michael Bass (Paul, Weiss, Rifkind, Wharton & Garrison LLP) of the New York bar, admitted pro hac vice, attorneys; Steven C. Herzog, of counsel and on the brief; Tanya Brief, Audra J. Soloway, David Cole, Robyn Bernstein, Kirsten Dedrickson, and Michael Bass, on the brief).

Nakul Y. Shah argued the cause for amici curiae The Innocence Network and Center for Integrity in Forensic Sciences (Riker Danzig LLP, attorneys;

Lance J. Kalik, of counsel and on the brief; Nakul Y. Shah, on the brief).

Ethan Kisch argued the cause for amici curiae Biomechanical Engineers Lindsay "Dutch" Johnson, Ph.D., Ken Monson, Ph.D., and Kirk Thibault, Ph.D., D-IBFES (Gibbons PC, attorneys; Lawrence S. Lustberg and Ethan Kisch, on the brief).

The opinion of the court was delivered by

GOODEN BROWN, J.A.D.

In these appeals, we consider the scientific reliability of expert testimony that shaking alone can cause the injuries associated with shaken baby syndrome (SBS), also known as abusive head trauma (AHT). The State sought to admit the testimony to prove aggravated assault and child endangerment charges against defendants Darryl Nieves and Michael Cifelli, fathers of infant sons who exhibited associated symptoms while in their respective fathers' care. Following a Frye[1] hearing, Judge Pedro J. Jimenez, Jr.

[1] Frye v. United States, 293 F. 1013 (D.C. Cir. 1923). Recently, in State v. Olenowski, 253 N.J. 133, 153 (2023), our Supreme Court held that New Jersey courts will no longer apply the Frye standard for admissibility, and will instead rely upon a "Daubert-type standard in criminal cases." See Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993). Under Daubert, general acceptance in the scientific community can still "have a bearing on the inquiry," as it does under the Frye standard, but "is not a necessary precondition" to admissibility. Daubert, 509 U.S. at 594, 597. Because the holding in Olenowski is not retroactive, id. at 154, our review of the trial court's decision is governed by the Frye standard, and we take no position on the outcome under a "Daubert-type" analysis. Id. at 153.

concluded that expert testimony of shaking-only SBS/AHT was not scientifically reliable, barred admission of the evidence at Nieves's trial, and dismissed the indictment against Nieves. Over the State's objection, Judge Benjamin S. Bucca, Jr. adopted the decision barring the testimony, ruling that the parties had previously agreed to be bound by Judge Jimenez's decision in the Nieves matter in the prosecution of Cifelli.

We granted the State leave to appeal orders relating to both defendants and now consolidate the appeals for purposes of this opinion. The State challenges Judge Jimenez's decision dismissing Nieves's indictment based on the purported inadmissible evidence, arguing it established SBS/AHT's general acceptance within the medical community through expert testimony and supporting authoritative scientific studies. The State also appeals Judge Bucca's order entered in the Cifelli matter, arguing it never agreed to be bound by the decision in the Nieves matter and, in any event, the decision was wrong.

We affirm both judges' decisions. The evidence supports the finding that there is a real dispute in the larger medical and scientific community about the validity of shaking only SBS/AHT theory, despite its seeming acceptance in the pediatric medical community. Where the underlying theory integrates multiple scientific disciplines, as here, the proponent must establish cross-disciplinary validation to establish reliability. The State failed to do that here.

Indeed, all the experts at the hearing agreed that, at the very least, there was controversy surrounding the theory that the biomechanical principles underlying SBS/AHT actually supported the conclusion that shaking only can cause the injuries associated with SBS/AHT.

I.

A. Nieves

In early February 2017, within a two-week period, Nieves's son, D.J.,[2] had three medical episodes where his body became limp and he appeared to lose consciousness. D.J. was eleven months old at the time and Nieves was caring for D.J. on all three occasions. The third incident—during which D.J. had a seizure—resulted in the infant's hospitalization and triggered a child abuse investigation against Nieves.

D.J.'s medical history showed that he was born premature in March 2016, at twenty-five weeks of gestation, due to complications related to preeclampsia, a potentially dangerous pregnancy condition involving high blood pressure that can cause damage to the mother's organs and even death. Upon his birth, D.J. remained at Saint Peter's University Hospital (Saint Peter's) through October 2016, but for two temporary stays at the Children's

[2] We use initials to protect the privacy of the child-victim pursuant to Rule 1:38-3(c)(9).

Hospital of Philadelphia (CHOP) in May and July 2016, when he underwent cardiac surgery. Following his discharge, D.J. lived with his mother and Nieves, who acted as his primary caregiver.

Based upon D.J.'s history and presenting symptoms when he was admitted to Saint Peter's in February 2017 following his third episode of limpness, Dr. Gladibel Medina, a child abuse pediatrician, diagnosed D.J. with SBS/AHT, with shaking only,[3] "within a reasonable degree of medical certainty." As a result, on June 30, 2017, Nieves was indicted by a Middlesex County grand jury and charged with second-degree aggravated assault, N.J.S.A. 2C:12-1(b)(1), and second-degree endangering the welfare of a child, N.J.S.A. 2C:24-4(a)(2).

On July 2, 2018, Nieves moved for a Frye hearing to challenge the scientific reliability of the SBS/AHT hypothesis and preclude Medina's related testimony at his trial. Nieves argued that SBS/AHT was no longer accepted in the scientific community. Although Judge Jimenez initially denied the hearing request, we granted Nieves's motion for leave to appeal the denial and

[3] AHT is the current terminology used to describe the theory. Because the parties and the experts refer to both terms, we refer to them as SBS/AHT in this opinion. Although there is a distinction between SBS/AHT with shaking only versus SBS/AHT with impact, unless otherwise stated, SBS/AHT as used in this opinion refers to shaking only as that is the primary dispute on appeal.

remanded for a Frye hearing, which the judge conducted on five diverse dates between September 24 and October 15, 2020.

Following the hearing, on January 7, 2022, Judge Jimenez issued an order and accompanying seventy-five-page written decision granting Nieves's motion and prohibiting expert SBS/AHT testimony at trial. On January 28, 2022, the judge denied the State's motion for reconsideration. Finding that the State was unable to prove causation without Medina's SBS/AHT testimony, the judge granted Nieves's dismissal motion and dismissed the indictment without prejudice. A memorializing judgment of dismissal was entered on February 11, 2022.

B. Cifelli

In late December 2016 and early January 2017, Cifelli's ten-week-old son, J.C., went to the hospital twice. The first visit occurred after J.C. exhibited excessive vomiting, fatigue, and a fever. The symptoms were attributed to a "G.I. illness" and "viral infection." The second visit was due to J.C.'s vomiting and seizure-like activity and resulted in the infant's hospitalization. Cifelli was caring for J.C. both times. The second incident triggered a child abuse investigation against Cifelli.

During J.C.'s hospitalization following the second incident, his symptoms included: fluid around the brain, which required surgery to drain

the fluids; old and new brain bleeds; intraretinal and submacular retinal hemorrhages, meaning blood in multiple layers of J.C.'s eyes; an apparent macular hole in his right eye, which was later diagnosed as "foveal vitreoretinal traction"—marked by the gel-like substance between the lens of the eye and the retina pulling away from the retina; and a sudden increase in J.C.'s head circumference. Based upon J.C.'s medical history, which showed that J.C. was born premature in November 2016, and presenting symptoms, Medina diagnosed him with SBS/AHT with or without impact, finding that there was no other medical diagnosis that could explain his symptoms.

On November 1, 2017, Cifelli was indicted by a Middlesex County grand jury and charged with second-degree aggravated assault, N.J.S.A. 2C:12-1(b)(1); and second-degree endangering the welfare of a child, N.J.S.A. 2C:24-4(a)(2).[4] Relying on the dismissal of a related Title 9 complaint filed by the Division of Child Protection and Permanency (DCPP) alleging child abuse and neglect, Cifelli moved to dismiss the indictment.[5] Judge Bucca denied the

[4] Subsequently, on October 20, 2021, a second indictment was returned against defendant and J.C.'s mother, Alexandria Newton, charging them with additional acts of child endangerment against both J.C. and his sibling. That indictment is not the subject of this appeal.

[5] The Family Part's dismissal of the Title 9 complaint did not involve a determination about the scientific reliability of the SBS/AHT hypothesis, but

motion. Thereafter, Cifelli moved for a Frye hearing to challenge the admissibility of Medina's SBS/AHT testimony, which the judge initially denied, finding that SBS/AHT was generally accepted by the scientific community and therefore reliable.

However, after we granted Nieves's motion for leave to appeal Judge Jimenez's denial of a Frye hearing and remanded the matter for a hearing, Cifelli moved for reconsideration of the denial in his case. Although no written order was issued on Cifelli's reconsideration motion, the parties agreed to hold the matter in abeyance pending the outcome of the Frye hearing in the Nieves matter. Once Judge Jimenez issued his decision in the Nieves matter barring expert SBS/AHT testimony, Cifelli moved to dismiss his indictment, citing the parties' purported agreement to be bound by the Frye ruling in the Nieves matter. The State opposed the application, asserting that while it had agreed to await the outcome of the Frye ruling in the Nieves matter, it never agreed to be bound by the ruling. On March 29, 2022, following oral argument, Judge Bucca ruled that both sides had agreed to be bound by the ruling and, pursuant to that agreement, adopted Judge Jimenez's Frye ruling in

---

rather the sufficiency of the evidence that J.C.'s injuries were attributable to SBS/AHT, as opposed to a different pathology.

the Nieves matter. However, Judge Bucca did not dismiss the indictment against Cifelli.[6]

C. Frye Hearing

The State's sole witness at the Frye hearing was Medina, a child abuse pediatrician and medical director at the Dorothy B. Hersh Regional Child Protection Center at Saint Peter's, who evaluated D.J. at DCPP's request. Medina testified as an expert in pediatrics and child abuse pediatrics. Nieves presented three expert witnesses: (1) Dr. Joseph Scheller, who testified as an expert in the fields of pediatric neurology and neuroimaging;[7] (2) Dr. Julie Mack, who testified as an expert in the fields of radiology and pediatric radiology; and (3) Dr. Chris Alan Van Ee, who testified as an expert in biomechanics. The parties also introduced into evidence and discussed numerous scientific studies and articles during the hearing.

Medina recounted D.J.'s three "episode[s] of alteration in awareness" while Nieves was caring for him. Although D.J. was eleven months old at the time of these episodes, developmentally, he was "at a level of a [three] to

---

[6] At the time, there was a pending motion to join the additional charges against Cifelli and J.C.'s mother to this case.

[7] The judge qualified Scheller as an expert in neuroimaging over the State's objection. The State argued Scheller was not a radiologist and was not board certified by the American Academy of Medicine in this subspecialty.

[four] month[]" old, and was not ambulatory. According to Medina, the first episode occurred on or about February 3, 2017, when D.J. "became unresponsive" during a diaper change, and Nieves "blew in his mouth" to revive him. Nieves notified D.J.'s mother, who was home at the time, and they called 911.

D.J. "was better" by the time paramedics arrived and the parents elected to follow-up with D.J.'s pediatrician, rather than having D.J. transported by ambulance to the hospital. The pediatrician thought D.J.'s symptoms were triggered by acid reflux and directed the parents to exercise "reflux precautions," such as keeping the infant's head elevated "to avoid vomiting." His parents reported that D.J. was "a little bit more irritable and cranky" in the following days and vomited or had reflux "twice a day."

Medina testified that the second incident occurred on February 8, 2017, also during a diaper change. During that episode, D.J. again "went limp." Nieves administered "oxygen via nasal cannula" to D.J., which revived him. The third incident occurred on February 10, 2017. Medina testified that, according to the parents, when Nieves picked D.J. up from a seated upright position for a diaper change, D.J. "all of a sudden went limp." D.J. had what Medina described as a "seizure-like episode," and experienced both "limpness" and "stiffening." Nieves notified D.J.'s mother, and they called for an

ambulance. Because of the presenting symptoms, D.J. was admitted at Saint Peter's and remained there for approximately three weeks.

When D.J. arrived at St. Peter's, he did not have any external physical injuries, such as broken limbs, bruising, or neck injuries. During his stay, he was examined by several specialists, including a neuroradiologist, pediatric ophthalmologist, geneticist, hematologist, and neurologist. A neuroradiologist conducted an MRI and determined that D.J. had "subdural bleeding at different stages of evolution." A pediatric ophthalmologist identified "[m]ultiple, severe preretinal, intraretinal, and subretinal hemorrhages in both eyes." A neurosurgeon and neurologist tested and cleared D.J. of seizure disorders and any underlying "metabolic" or "genetic" conditions that could cause his symptoms.

Based on these and other findings, the hospital notified DCPP, and Medina was selected to conduct a comprehensive evaluation of D.J. based on "suspicion of abuse." After considering information provided by D.J.'s parents as well as his medical history and examination results, in April 2016, Medina opined that D.J. was subjected to child physical abuse and specifically diagnosed D.J. with SBS/AHT, with or without impact. Medina's evaluation included considering alternate diagnoses for D.J.'s symptoms, known as a differential diagnosis. See Creanga v. Jardal, 185 N.J. 345, 357-58 (2005)

(accepting the use of a properly conducted differential diagnosis in the medical community).

Medina testified that, according to the Centers for Disease Control and Prevention (CDC), SBS/AHT is defined as "an inflicted injury of the skull . . . in an infant or a child under five years caused by violent shaking, blunt head impact or a combination of both." Medina explained that SBS/AHT results from "the movement of the brain inside the skull," which causes "acceleration and deceleration" and "creates rotational forces" inside the head. According to Medina, these forces create "tension" in the "bridging veins"[8] of the head, causing the veins to tear or leak, "producing blood in the intracranial cavity."

Medina was adamant that SBS/AHT was not a biomechanical finding,[9] but a "clinical diagnosis." Medina explained that AHT was previously known as "shaken baby syndrome," but in 2009, the American Academy of Pediatrics broadened the term to "abusive head trauma," or AHT. She added that the renaming was not meant as a rejection of shaking as a mechanism of injury,

---

[8] Mack and Scheller described bridging veins as large veins located in between the brain and the skull, which transport blood to larger blood vessels, which then deliver the blood to the heart.

[9] Scheller and Van Ee explained that biomechanics is the study of the "mechanics of injury" by means of measuring force. For example, a biomechanical test will inflict different types of force against crash test dummies to measure the levels of force and determine where impact occurs on the body.

but because AHT more accurately reflected all mechanisms of intracranial injury.

Medina identified specific symptoms associated with SBS/AHT, including: subdural hematomas, retinal hemorrhages, seizures, lethargy, scalp swelling, neck injury, fractures or external bodily injury, injury to nerve tissue, injury to the spinal cord, and bruising. She testified that a "triad of symptoms" was "used to support a diagnosis and a finding" of SBS/AHT. She specified that the triad consisted of: (1) "subdural hemorrhages"; (2) "severe retinal hemorrhages"; and (3) "encephalopathy." She testified that "the triad itself [was] not diagnostic, but the combination of findings, in the absence of pathology, [was] what gives the final diagnosis."

Medina defined a subdural hemorrhage as "bleeding under the dural membrane." She explained that technically "[s]ubdural space does not exist," but is "created when there's blood vessel damage, leakage of blood from blood vessels, and collection of blood in that area." She said that a subdural hemorrhage is mostly caused by "trauma," but a finding of a subdural hemorrhage alone did not support "a diagnosis of abuse," as it could be "found with other abnormalities."

Turning to retinal hemorrhages, Medina explained that the retina has three primary layers—the preretinal, intraretinal, and subretinal layers—and

the retina has blood vessels that "occupy the back of the eye" and "extend to the front of the eye." She said that shaking created "acceleration/deceleration rotational forces" which caused the jelly-like substance within the eye—the vitreous—to "pull against the retina causing rupture of the retinal vessels." Medina stated that retinal hemorrhages can also be caused by "disease, illness, accidental trauma, or inflicted injury," but "retinal hemorrhages that are observed in inflicted injury" involved a specific "pattern." Such hemorrhages were severe and multilayered—visible on more than one of the preretinal, intraretinal, and subretinal layers—and presented at the front and back of the eye.

Medina explained that the encephalopathy or neurological symptoms referred to "the outward presentation or demonstration of something that has gone wrong intracranially." She stated that "encephalopathy" was "the external presentation of intracranial trauma," and included "unresponsiveness, apnea, seizures, [and] altered mental status."

Medina testified that a child abuse investigation was triggered by the presence of certain symptoms, viewed in conjunction with the child's medical history, the stated reason for the hospital visit, any inconsistencies between the stated reason for the visit and the infant's presentation of symptoms, whether the type of injury was "developmentally possible" based on the infant's age,

and any changes in the infant's demeanor and behavior. Once a child abuse evaluation was triggered, a child abuse pediatrician worked with various pediatric specialists, reviewing the child's "medical history," "physical findings," "laboratory tests," and "imaging studies" to rule out alternate medical explanations for the child's symptoms. Medina stated that this process of diagnosing SBS/AHT was widely accepted in the medical community.

Medina attributed D.J's subdural hemorrhage detected in his MRI to the "tearing of the bridging veins in [his] brain." Medina said the pediatric ophthalmologist's finding of "[m]ultiple, severe preretinal, intraretinal, and subretinal hemorrhages in both eyes" was consistent with the pattern associated with SBS/AHT. Further, intraretinal hemorrhages usually resolved within two weeks following trauma and D.J.'s results indicated a recent event.

Acknowledging his premature birth and the associated medical and developmental issues, Medina found that D.J.'s past neurosonograms showed "normal" brain structure and subarachnoid spaces, and "did not reveal any subdural hemorrhage[s]." Similarly, although D.J. had "mild retinopathy" at his premature birth—meaning "abnormally growing blood vessels in the back of his eye"—he was "found to have healthy mature . . . retinas without any abnormalities" or "hemorrhages" at six months old.

Medina also considered whether D.J. experienced any "volume loss" in his head, as changes in head circumference "could predispose him to having subdural collections." Reviewing his head circumference growth rates, Medina found that from birth through January 2017, D.J. had "steady" head growth within the twenty-fifth and fiftieth percentile range. However, when he was admitted to Saint Peter's in February 2017, his head circumference made a "significant jump"—measuring between the fiftieth and seventy-fifth percentile range—which, Medina stated, could be attributed to "the subdural collection in his brain."

As part of her differential diagnosis, without further explanation, Medina ruled out other causes for D.J.'s retinal hemorrhaging, including seizures, cardiopulmonary resuscitation (CPR), vaccination status, coughing, or reflux. Medina also rejected D.J.'s parents' account that his symptoms could have been attributed to his four-year-old half-brother jumping in the crib with D.J. Medina explained that the incident occurred a month prior, and D.J.'s "retinal hemorrhages [were] acute."

Medina made the diagnosis of "abusive head trauma, as occurs with a shaking event with or without impact" because there "was no explanation for [D.J.'s] presentation in terms of other potential accidental trauma," and "[e]verything else was ruled out by the treating providers." Medina opined

that D.J.'s diagnosis was either shaking with "impact into a soft surface, because he [did not] have any external signs of trauma," or shaking alone.

In contrast, Van Ee questioned the idea that vigorous shaking could "rip[] a bridging vein" without also injuring the neck. He testified that "the neck is very weak and vulnerable to injury" and, from a biomechanical perspective, it would be "the first place to look for injury." Mack disagreed that subdural collections are always the result of trauma, or attributable to torn bridging veins. She also noted that torn bridging veins would constitute a "surgical emergency" due to the large amount of blood flow through those veins, and distinguished D.J.'s brain scans from those of children who had suffered from ruptured bridging veins.

Instead, Mack identified benign enlargement of the subarachnoid spaces (BESS) as a possible diagnosis for D.J. She defined BESS as an "anatomic variation" where a child has fluid around the brain in the subarachnoid or subdural space. Although Medina ruled out BESS as a potential cause of D.J.'s symptoms, Mack opined that D.J. had BESS because his neuroimaging showed that D.J.'s "subarachnoid space was slowly expanding"; the subarachnoid space mainly seemed to have fluid, not blood; and there was no sign of injury. Mack testified that a BESS diagnosis would account for D.J.'s increased head

circumference, the subdural fluid collections, and even his retinal hemorrhages.

Scheller testified that D.J.'s scans indicating a "large fluid collection" and only a "tiny sliver of recent blood clotting" evidenced that D.J. had a "subdural hygroma," which he described as a "plumbing problem," where fluid collects in the brain. According to Scheller, subdural hygroma would account for D.J.'s retinal hemorrhages, his seizures, and his increased head circumference. Scheller attributed D.J.'s hygroma to his premature birth, noting that this was a common finding in premature babies, but acknowledged that subdural hygroma could also result from minor trauma. Although Scheller agreed that shaking a baby was not "a good thing," he posited that the problem was that nobody knew "for sure" what type of harm it actually caused. Thus, he criticized a SBS/AHT diagnosis due to "the lack of . . . scientific data" to support the injuries associated with shaking only SBS/AHT.

The experts' testimony referenced various scientific studies and articles introduced at the hearing. The articles showed the evolution of SBS/AHT, evaluated the various studies done to test the theory, and commented on the reliability of the theory. Medina acknowledged that the "foundation" of the SBS/AHT hypothesis—that head injuries can be caused by a whiplash or shaking event—stemmed from a 1968 biomechanical concussion study by

A.K. Ommaya. A.K. Ommaya et al., Whiplash Injury & Brain Damage: An Experimental Study, 204 J. Am. Med. Assoc. 285 (1968). Ommaya's testing involved strapping monkeys into a chair with wheels, accelerating them to a speed of thirty miles per hour, and then braking to create a whiplash event to mimic a rear-end collision. Id. at 286. The study concluded that a whiplash event at thirty-miles-per-hour could cause "rotational displacement of the head" and, "without direct impact to the head," could cause concussions, "subarachnoid and subdural hemorrhage" and "cerebral contusions." Id. at 285-86.

A study by A.N. Guthkelch built upon Ommaya's research and connected subdural hematomas from whiplash injuries to SBS/AHT. A.N. Guthkelch, Infantile Subdural Haematoma & its Relationship to Whiplash Injuries, 2 British Med. J. 430 (1971).[10] Although the study was not offered into evidence at the hearing, the experts referenced Guthkelch's findings in their testimony and the study was provided in the record.

Guthkelch stated that subdural hematomas in infants were most commonly caused by the rupture of the bridging veins in the head, which could be caused by impact or non-impact events. Id. at 430. Citing Ommaya's

[10] The words hematoma and hemorrhage are sometimes spelled differently in the articles cited. Because these alternate spellings are correct, they have not been corrected when quoting the articles.

study, Guthkelch posited that shaking an infant could cause subdural hematomas. Ibid. In so doing, he noted that "the relatively large head and puny neck muscles of the infant must render it particularly vulnerable to whiplash injury." Ibid. Reviewing a study of twenty-three "proved or strongly suspected paternal assault" cases on children, Guthkelch noted that of thirteen children with subdural bleeding, seven had no skull fractures and five had no external injuries to the head. Id. at 430-31. Guthkelch concluded that "all cases of infantile subdural haematoma are best assumed to be traumatic unless proved otherwise," and that where there are subdural hematomas and no significant external injury, one should consider whether it is from shaking. Id. at 431.

Ommaya's study was also relied upon by John Caffey, who first coined the term "shaken baby syndrome" in his 1974 study involving confessed SBS/AHT cases. John Caffey, The Whiplash Shaken Infant Syndrome: Manual Shaking by the Extremities with Whiplash-Induced Intracranial & Intraocular Bleedings, Linked with Residual Permanent Brain Damage and Mental Retardation, 54 Pediatrics 396 (1974). Although the article was not offered into evidence, Caffey's findings were discussed by all the experts and the study was provided in the record. Caffey reviewed confession cases where the perpetrators admitted to shaking. Id. at 397-99. He noted that shaken

babies often lacked external signs of trauma but suffered from "massive traumatic intracranial and intraocular bleeding." Id. at 399. Caffey thus considered how shaking alone caused these injuries, noting that "[t]he normal infantile brain and its blood vessels are highly vulnerable to whiplash stresses" because the infant head was "relatively heavier," and the neck muscles were weaker. Id. at 401.

According to Caffey, these structural features "maximized" the "whiplash stresses" from shaking an infant. Ibid. Additionally, Caffey stated that an infant's brain and the blood vessels therein—the bridging veins—were "relatively larger and more stretchable," which could result in "excessive tearing" and stretching. Ibid. Caffey agreed that a "single manual shake of an infant may be less forceful and pathogenic than the single whiplash in an automobile accident," but said repeated shaking "may be much more harmful to the brain and the intracranial blood vessels and also to the veins in the eyes." Ibid. Caffey did not elaborate on how he reached this conclusion but suggested that "[c]urrent evidence, though manifestly incomplete and largely circumstantial, warrants a nationwide educational campaign" on SBS/AHT. Id. at 403.

Van Ee explained that Caffey interpreted Ommaya's study as supporting "this idea that shaking could cause injuries to children." Van Ee disagreed

with this interpretation, however, because the level of force measured in Ommaya's study was "not something that a human can generate in shaking." Rather, according to Van Ee, a shaking event would be more akin to a "low speed rear-end sort of accident," in terms of acceleration forces. Van Ee stated that Ommaya similarly criticized Caffey's reliance on his 1968 study, referencing a 2002 article by Ommaya, which was not offered at trial but was included in the record on appeal. A.K. Ommaya et al., Biomechanics & Neuropathology of Adult & Paediatric Head Injury, 16 Brit. J. of Neurosurgery 220 (2002).

In the article, Ommaya noted that "Caffey, Gulthkelch and others" had relied upon his prior study to support their findings about SBS/AHT, without necessarily realizing that his prior study involved acceleration levels "for motor vehicle crashes at [thirty] mph." Id. at 221. He stated that it was "improbable that the high speed and severity of the single whiplash" event from his study "could be achieved by a single manual shake or even a short series of manual shaking of an infant in one episode." Ibid.

Considering the acceleration forces with SBS/AHT with shaking only, Ommaya said that the "values are well below thresholds for cerebral contusion, [subdural hematomas], subarachnoid haemorrhage, deep brain haemorrhages and cortical contusions." Id. at 226. While Ommaya stated that prolonged,

severe shaking could cause trauma to the infant brain, including cerebral and cervical spinal cord trauma, he noted that this type of injury could also cause physical injuries, such as soft tissue bruising or skeletal fractures, and would cause neck injuries. Id. at 222, 225. As for retinal hemorrhaging, Ommaya stated that "smaller masses require higher levels of force to cause damage" as compared to higher masses, and that "the levels of force required for retinal bleeding by shaking to damage the eye directly is biomechanically improbable." Id. at 233.

Ommaya also questioned the methodology involved in a differential diagnosis of SBS/AHT, stating that it relied upon various assumptions which were "ambiguous or incorrect," such as: shaking can "directly" disrupt bridging veins, causing subdural hematomas; shaking can cause retinal hemorrhages; short falls cannot cause subdural hematomas; trivial trauma cannot cause subdural hematomas which can re-bleed; and there was no lucid interval between injury and manifestation of symptoms. Id. at 227.

Nevertheless, Medina pointed to other studies that continued to rely on Ommaya's 1968 study, by utilizing different animal models, computerized models, anthropomorphic dolls, and crash dummies. For example, Medina testified about a 1987 study by Ann-Christine Duhaime, which built off the Ommaya study to determine whether vigorous shaking of an infant could

indeed reach the injury thresholds for intracranial trauma. Ann-Christine Duhaime et al., The Shaken Baby Syndrome: A Clinical, Pathological, & Biomechanical Study, 66 J. Neurosurgery 409 (1987).

Duhaime conducted her own biomechanical test using biofidelic dolls representing a one-month-old baby, designed with three different neck structures. Id. at 411-12. The dolls were implanted with an accelerometer to measure the results of shaking and impact. Id. at 411. As described by Scheller, Duhaime sought to create forces "powerful enough to create a subdural hematoma." Medina explained, however, that Duhaime could not replicate the same level of force with shaking alone, although she found that shaking with impact did generate the requisite level of force.

Based on her results, Duhaime concluded that shaking alone could not cause fatality, the "most severe acute form" of SBS/AHT. Id. at 414. Moreover, Duhaime stated that "the angular acceleration and velocity associated with shaking" fell "well below the injury range," whereas incidents involving impact fell in the injury range for concussions, subdural hematomas, and diffuse axonal injury ranges. Ibid. Based upon her testing, Duhaime concluded that "shaking alone does not produce the shaken baby syndrome." Id. at 409. However, as Medina, Van Ee, and Scheller recognized, Duhaime's conclusion was not that shaking alone can never cause injury, but that fatality

from SBS/AHT was not usually caused by shaking alone. Nonetheless, Medina acknowledged that since Duhaime's study, there has been debate about whether shaking alone can reach the threshold for injuries needed to support an SBS/AHT diagnosis.

A subsequent study by C.Z. Corey and M.D. Jones attempted to replicate Duhaime's study by using a different type of doll. C.Z. Corey & M.D. Jones, Can Shaking Alone Cause Fatal Brain Injury?, 43 Med. Sci. & L. 317. Specifically, Corey and Jones replicated the doll used by Duhaime, but allowed the "standard head" to be removed and fitted with "a modified head with a more realistic neck insertion point." Id. at 321. They also switched out the doll's neck, using three different neck structures. Ibid. They then measured the "impact tolerance limits" of shaking using the different types of dolls, which resulted in "both chin-to-chest and back of head (occiput)-to-back impacts,"—meaning the doll's chin hit its chest, and the back of its head then hit its back. Id. at 325, 332. The tolerance limits surpassed those found in the Duhaime study. Id. at 332. Based on their diverse findings, Cory and Jones cautioned that future studies should "simulate an infant as accurately as possible." Id. at 329.

Cory and Jones questioned whether such "end-point" impacts were "anatomically possible" in real infants, and noted that other studies also had

models which resulted in end-point impacts, which in turn affected the acceleration of the dummy's head and produced "increased tensile neck forces." Id. at 325-26. The study posited that if such end-point impacts were possible from shaking alone, then when determining injury thresholds, one should look to "impact tolerance limits," as opposed to only "the currently applied angular acceleration (shaking) data." Id. at 327-28.

While the injury thresholds in Cory's and Jones's study were greater than those found by Duhaime, Van Ee distinguished the study's findings because it involved impact—when the chin hit the chest and the head hit the back of the spine—which then caused great levels of acceleration. Moreover, Van Ee noted that although those impact levels reached "the threshold for concussion," they did not "reach the levels for subdural or diffuse axonal injury."

At the hearing, the experts also referenced a biomechanical study conducted by Michael T. Prange, who compared "rotational velocities" between "shaking, shaking with impact, and falls" on different surfaces. Michael T. Prange et al., Anthropomorphic Simulations of Falls, Shakes & Inflicted Impacts on Infants, 99 J. Neurosurgery 143 (2003). Prange's testing involved the use of an anthropomorphic doll to match a one-and-one-half-month-old baby. Id. at 144. As explained by Van Ee, the study "tr[ied] to understand . . . what's the head acceleration that's happening under these

situations," and looked at the properties of the neck and skull stiffness "to envelope the responses" between the two to determine "the response of a real infant." Van Ee explained that, according to the study, "both the one-foot falls onto concrete and carpet have greater exposure, have greater head angular acceleration than what is achieved during shaking."

Prange noted some flaws in his study, including differences in skull formation, neck strength, and neck motion in real infants, such that the test overestimated the level of angular acceleration and rotational motions. Id. at 147-48. Prange also noted that while subdural hematomas were "produced by, and correlated to, the angular velocity or angular accelerations of the head," and the anthropomorphic testing data was "useful to evaluate the rotational responses of the head," he cautioned that the tests could not predict whether the forces were "sufficient to cause injury," due to a lack of "[r]egional tissue thresholds specific to the infant." Id. at 148.

Nevertheless, Prange calculated the likelihood of injury using "a more qualitative approach," which correlated the "measured accelerations and changes in velocity" with the documented injury thresholds from other studies involving cadavers, animals, and human test subjects. Ibid. He found that the angular velocity and angular accelerations associated with shaking were lower than any of this recorded data. Ibid. Thus, Prange stated there was no data

demonstrating that the angular velocity and angular acceleration associated with shaking could cause subdural hematomas. Ibid. As explained by Van Ee, Prange concluded "we still don't have any data that says shaking can give rise to the injuries associated with it" and that "the term shaking should not be used in legal settings" because "there's not a scientific basis from biomechanics to support this idea."

Van Ee also testified about a 2017 study by Carole A. Jenny, which involved a crash test dummy representing a five-pound newborn. Carole A. Jenny et al., Biomechanical Response of the Infant Head to Shaking: An Experimental Investigation, 34 J. Neurotrauma 1 (2017). Jenny's study resulted in peak angular acceleration and angular velocity levels higher than those recorded by Duhaime and Prange, likely due to "differences in the surrogates used to represent an infant," and possibly also due to "differences in the delivery of shaking by volunteers." Id. at 4-5. Jenny noted that the Cory and Jones's study approached her recorded peak angular acceleration levels. Id. at 6.

Without clearly stating how the recorded outcomes correlated with injury thresholds, Jenny's article addressed the various limitations in extrapolating the data to calculate the likelihood of injury. Id. at 8. These limitations included the lack of "validated infant brain injury thresholds"; the

risk of calculating "misleading" levels when attempting to scale injury thresholds for adult cadavers or primates; the lack of animal models involving repeated shaking, which, she said, "have been shown to cause greater injury at lower peak rotational velocities than do single impulse loads"; the fact that longer duration of events may produce injury at lower levels of acceleration; the lack of data on the biomechanical properties of the infant neck; and the complicated "pathophysiology" and vulnerability of an infant brain that cannot be replicated through the use of surrogate models. Ibid. Thus, Jenny concluded that attempts to predict injury thresholds would not be reliable "given the limitations inherent in these thresholds." Ibid.

Van Ee testified that Jenny's outcomes did not reach the injury thresholds. Van Ee also noted that Jenny had done an earlier study in the 2000s that measured levels of acceleration associated with falls. Jenny's earlier study was not introduced into evidence and involved greater acceleration levels than those reached "during a shake." As a result, Van Ee explained that Jenny's later study suggested that "the biomechanical data did not support the clinical thinking" about SBS/AHT.

Finally, the parties referred to two biomechanical studies by John W. Finnie, who tested lambs by shaking them and dissecting them to examine their injuries. Finnie chose lambs as the test subjects because they had some

similarities with human infants' brain structures and neck muscles. John W. Finnie et al., Neuropathological Changes in a Lamb Model of Non-Accidental Head Injury (the Shaken Baby Syndrome), 19 J. Clinical Neuroscience 1159 (2010).

In the first study, Finnie tested seven lambs by having them "vigorously shaken with enough force to snap the head back and forth onto the chest, similar to the actions believed to occur in the SBS." John W. Finnie et al., Diffuse Neuronal Perikaryal Amyloid Precursor Protein Immunoreactivity in an Ovine Model of Non-Accidental Head Injury (the Shaken Baby Syndrome), 17 J. Clinical Neuroscience 237 (2010). The results showed a small subdural hemorrhage in two lambs, and "minimal" retinal hemorrhaging in two lambs. Id. at 239.

In the second study, Finnie tested nine lambs through "vigorous[]" shaking. Finnie, Neuropathological Changes in a Lamb Model of Non-Accidental Head Injury (the Shaken Baby Syndrome), 19 J. Clinical Neuroscience at 1159. The notable findings from the second study were as follows: (1) three of the "lower body weight" lambs died after the last episode of shaking; (2) subdural hemorrhaging was only found "macroscopically"; (3) microscopic subarachnoid hemorrhaging was "infrequent[]" and more common

in the lower body weight group; and (4) no retinal hemorrhages were detected. Id. at 1160-63.

Finnie stated that the death of several lambs supported the view that non-accidental head injury can result from shaking only. Id. at 1164. That said, Finnie concluded that "[t]he pathological and biomechanical aspects" of SBS/AHT "remain[ed] controversial." Ibid. Finnie cautioned against a diagnosis of non-accidental head injury "unless there is other corroborating evidence of abuse or a convincing admission by the perpetrator." Ibid. Finnie stressed the following findings: (1) the mechanisms of brain injury can vary; (2) a reliable history of past abuse is "usually lacking"; (3) there is no specific pathognomy for accidental injury versus inflicted injury; and (4) there are usually no external symptoms, which, he said, was not determinative in and of itself. Ibid.

Van Ee conducted his own study measuring levels of acceleration for different types of injury. Van Ee organized incidents into groups, such as car crashes and a one-foot fall on a linoleum floor. Van Ee explained that the purpose of the study was to look at head acceleration levels associated with different events. According to Van Ee, because SBS/AHT hypothesized that head acceleration caused injury, then all things that involved a higher level of acceleration than SBS/AHT should also cause that injury. Van Ee found,

however, that this was not the case. Van Ee's biomechanical studies did not show that "shaking can actually give the injuries that are associated with it," thus undermining the biomechanical hypothesis of SBS/AHT. Thus, while Van Ee agreed that shaking could cause injury, even death, he questioned whether such vigorous shaking could only result in the triad.

Van Ee also pointed out that biomechanical tests did not actually measure injury and instead measured levels of acceleration, which could then be compared to "injury reference values" to make "meaningful inferences" about what type of injuries can result from certain levels of acceleration. Van Ee similarly acknowledged the limitations of translating injury thresholds to humans from testing on non-humans, but noted that these models and tests were the same models and tests used to design bicycle helmets, child car seats, and playground flooring. Van Ee stated that if that science was viewed as reliable for those purposes, then "that same science should be valid when you apply it to another environment."

Scheller testified that he had not found any biomechanical studies that demonstrated that shaking alone could "create the amount of force that is thought to be needed . . . to make a baby suffer a subdural hematoma." Medina contended that the value of biomechanical studies was limited because the results varied based on factors such as the type of doll that was used or the

shaking pattern. Pointing to comments by Angell Shi from a 2019 study, Medina noted the limitations in scaling data from biomechanical testing to reflect infant injury threshold values. Angell Shi et al., Retinal Findings in Young Children with Increased Intracranial Pressure From Nontraumatic Causes, 143 Pediatrics 1 (2019).

Medina pointedly testified that infant brains "are significantly different than adult brains," because of different water content and weaker neck muscles. Thus, according to Medina, the biomechanical data had to be scaled from primates to adult human brains and then to infant brains. Medina explained that there was limited information about infant brains, and no model could accurately simulate it, so "no one really knows the injury thresholds that are required to cause injury [in] terms of biomechanics."

The State presented other studies discussing SBS/AHT. The studies largely fell into two groups: (1) articles which discussed the acceptance of SBS/AHT in the medical and scientific communities; and (2) confession studies, which examined findings of SBS/AHT in cases where the perpetrator had confessed to shaking the baby. Both sets of studies relied on clinical data, as opposed to biomechanical testing, to support the SBS/AHT hypothesis.[11]

[11] The parties submitted numerous articles on appeal that were not presented to the trial judge. In State v. Rochat, 470 N.J. Super. 392, 436 (App. Div.

To support the confession studies, generically, Medina described confessions as "the strongest evidence." In contrast, Scheller and Van Ee disputed the accuracy of confession studies, questioning the confessions based on when they were made, what exactly the person confessed to, and whether the event actually involved shaking only.

Medina testified about a confession study by Matthieu Vinchon, which compared forty-five cases of confessed "inflicted head injury" with thirty-nine cases of witnessed "accidental trauma" to determine whether these cases involved the triad of symptoms associated with SBS/AHT. Matthieu Vinchon, Confessed Abuse Versus Witnessed Accidents in Infants: Comparison of Clinical, Radiological, & Ophthalmological Data in Corroborated Cases, 26 Child's Nervous Sys. 637 (2010). Vinchon relied only on "confessions obtained from the judiciary," concluding that this set of data would be the most trustworthy. Id. at 642.

Vinchon's study found that the "inflicted" cases had a higher number of subdural hematomas than the accidental trauma cases, and a significantly

---

2022) (quoting State v. Harvey, 151 N.J. 117, 167 (1997)), we agreed that an appellate court should review "posttrial publications" to "account for the rapid pace of new technology" and to determine if there have been any changes in general acceptance "between the time of trial and the time of appellate review." However, several of the studies were available at the time of the hearing. Nevertheless, we have considered them because the parties did not object to the additional submissions.

higher number of retinal hemorrhages (severe retinal hemorrhages in fifty-six percent of the inflicted cases, as opposed to only six retinal hemorrhages – mostly mild – in the accidental trauma cases). Id. at 639-40. Given these statistics, Vinchon determined that severe retinal hemorrhages, "in the absence of facial trauma [were] specific of [inflicted head injury]" and the presence of such hemorrhages carried a "very high predictive value" for inflicted head trauma.[12] Id. at 644.

Vinchon made less firm findings about the rest of the triad, stating that the study showed "minimal" clinical manifestations of encephalopathy, and that while subdural hematomas were a "cardinal feature" in inflicted trauma, they also presented with other types of injuries and diseases. Id. at 643. He concluded that the "association" of subdural hematomas with "severe" retinal hemorrhages and the absence of signs of impact constituted "virtual certainty of abuse." Ibid.

Medina also referred to a confession study by Catherine Adamsbaum that looked at twenty-nine confessed cases of SBS/AHT, and compared them

---

[12] "'Positive predictive value' is the proportion of patients who have positive test results and actually have the disease or condition." Sandeep Narang, A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome, 11 Hous. H. Health L. & Pol'y 505, 538 (2011). It thus "reflects the probability that a positive test reflects the underlying condition being tested." Ibid. Specificity reflects "the chance that someone without the disease will actually have a negative test." Ibid.

to eighty-three cases where there was a diagnosis without confession. Catherine Adamsbaum et al., Abusive Head Trauma: Judicial Admissions Highlight Violent & Repetitive Shaking, 126 Pediatrics 546 (2010). All the cases involved subdural hematomas, as that was a criteria for inclusion in the study. Id. at 547. The study concluded that approximately eighty-eight percent of all patients had retinal hemorrhages, with about eighty-two percent in the confessed cases and about ninety percent in the diagnosed cases. Id. at 548-49. Adamsbaum stated the study confirmed "the role of shaking in the etiology of these injuries." Id. at 553. She acknowledged, however, that the "main limitation of the study is that perpetrator admissions are not scientific," and that confessions may be flawed, incomplete, or inaccurate. Ibid.

The Vinchon and Adamsbaum studies were examined in depth in a 2016 study by the Swedish Agency for Health Technology Assessment and Assessment of Social Services, which was referred to by the experts as the "SBU." Göran Elinder et al, Traumatic Shaking: The Role of the Triad in Medical Investigations of Suspected Traumatic Shaking, Report No. 255E (2016). The SBU selected these two studies because they were the only studies about SBS/AHT that were of "moderate quality" sufficient to warrant review. Id. at 20-22, 27. The SBU concluded that both studies "demonstrate that traumatic shaking can cause subdural hematoma and retinal hemorrhages."

Id. at 23. However, it noted that both studies had "methodological limitations." Id. at 27.

For instance, the Adamsbaum study required the presence of subdural hematomas as "a criterion for inclusion" in the study, and Vinchon failed to respond to the SBU's request for details surrounding the confessions. Id. at 27-28. The SBU also commented on the general unreliability of confession studies, noting the problem with circular reasoning, and the uncertainty in dating the age of a subdural hematoma. Id. at 29-30. The study concluded that there was limited scientific evidence that the triad could be associated with shaking, and that there was insufficient scientific evidence to assess the accuracy of the triad's role in identifying traumatic shaking. Id. at 5, 67. It also included a statement from the Swedish National Council on Medical Ethics, which opined that it was "ethically problematic for medical professionals to establish with certainty that certain specific injuries in infants are automatically evidence that they were caused by shaking." Id. at 67.

A subsequent article by Geoffrey David Debelle served as a critique of the SBU. Geoffrey David Debelle et al., Abusive Head Trauma & the Triad: A Critique on Behalf of RCPCH of "Traumatic Shaking: The Role of the Triad in Medical Investigations of Suspected Traumatic Shaking," 103 Archives of Disease in Childhood 1 (2018). Debelle rejected the premise that the presence

of the triad directly resulted in a SBS/AHT diagnosis, explaining that SBS/AHT was diagnosed when the triad was presented, but after a practitioner had reviewed the child's history and engaged in a differential diagnosis to rule out all potential causes for the presenting symptoms. Id. at 2.

Suzanne P. Starling examined inflicted traumatic brain injury cases with perpetrator admissions against a comparison group where there was no admission, to determine the time interval between the trauma and the onset of symptoms. Suzanne P. Starling et al., Analysis of Perpetrator Admissions to Inflicted Traumatic Brain Injury in Children, 158 Archives Pediatrics & Adolescent Med. 454 (2004). Of the sixty-nine children from the admitted trauma group, thirty-two involved SBS/AHT with shaking only, and of that group, ninety-one percent had subdural hematomas, and eighty-four percent had retinal hemorrhages. Id. at 456. Starling also noted that the shaking-only cases "were 2.39 times more likely to have retinal hemorrhages" than the impact only cases, which, she said, suggested that shaking was "more likely to cause retinal hemorrhages than impact." Id. at 457. Starling explained that in the confessed group, most perpetrators said they detected symptoms "immediately" after the shaking and/or impact. Id. at 456-57. According to Starling, this data "confirm[ed] recent studies showing immediate onset of symptoms in children who sustain primary head injury." Id. at 457.

To vouch for the studies evidencing acceptance of SBS/AHT in the medical community, Medina commented that SBS/AHT was "accepted by all the pediatric subspecialities involving intracranial injury, which are general pediatrics, pediatric ophthalmology, pediatric neurology, pediatric neurosurgery, pediatric radiology, [and] pediatric neuroradiology." She also cited a number of national and international organizations that have recognized the theory, including the American Academy of Pediatrics, the American Academy of Ophthalmology, the American Academy of Pediatric Ophthalmology and Strabismus, the Royal College of Ophthalmology, the Royal College of Pediatrics and Child Health, the Norwegian, Japan and Swedish Pediatric Societies, the American and European Societies for Radiology and Neuroradiology, the Latin American Society for Pediatric Regulatory, the American Professional Society for the Abuse of Children, the CDC, and the World Health Organization.

To further support the acceptance of SBS/AHT in the medical community, Medina referred to a "Consensus Statement" by numerous pediatric and radiological organizations in support of the diagnosis of SBS/AHT. Aribinda Kumar Choudhary et al., Consensus Statement on Abusive Head Trauma in Infants & Young Children, 48 Pediatric Radiology 1048 (2018). The Consensus Statement by Choudhary explained that

SBS/AHT was a "medical diagnosis" made by a team of medical professionals after consideration of all the facts and evidence. Id. at 1049.

The Choudhary Statement expounded that the significance of the triad had been mischaracterized, in that the presence of the triad did not automatically trigger an SBS/AHT diagnosis, but that such a diagnosis was based on all of the historical, clinical, and laboratory findings. Id. at 1051. The Statement explained that a diagnosis "signifies that accidental and disease processes cannot plausibly explain the etiology of the infant/child's injuries," and was meant as a medical conclusion, not a finding of intent of the perpetrator. Id. at 1050. The Statement also considered and cautioned against the use of alternate theories associated with the symptoms of SBS/AHT, including BESS, and concluded by noting that a consensus statement generally reflected "general physician acceptance" of the theory, in this case of SBS/AHT. Id. at 1056-57, 1059.[13]

In response to the Choudhary Statement, Papetti stated that "[t]he SBS/AHT diagnosis is premised on certain biomechanical and pathophysiological assumptions and beliefs, nearly all of which have been

[13] Amici curiae Medical Physicians assert, however, that the Consensus Statement did not reflect a true consensus by members of the organization, claiming that there was insufficient time given for members to vote, and that other members had voiced their objection.

shown to be unreliable." Randy Papetti et al., Outside the Echo Chamber: A Response to the "Consensus Statement on Abusive Head Trauma in Infants and Young Children", 59 Santa Clara L. Rev. 299, 303 (2019). Among other things, Papetti concluded that shaking creates low acceleration-deceleration forces which do not reach the injury thresholds; considered different causes for the triad, such as short falls; noted the absence of neck injury in SBS/AHT cases; and questioned whether the type of intracranial bleeding found in SBS/AHT cases was actually due to bridging vein rupture, as opposed to leakage, given the small amount of bleeding documented. Id. at 312-13, 318, 321-22.

In an article about the significance of bridging vein rupture and intracranial trauma, Caroline Rambaud stated that intracranial bleeding may be minimal because "the bleeding is venous, and therefore slow," and because brain swelling can impact bleeding. Caroline Rambaud, Bridging Veins & Autopsy Findings in Abusive Head Trauma, 45 Pediatric Radiology 1126, 1127 (2015). The article also noted that bridging veins are weaker in the subdural portion of the brain, as compared to the subarachnoid portion, due to structural differences in the veins, and thus tore more easily. Id. at 1128. The article recommended conducting autopsies to ascertain the type of bridging vein rupture to help confirm whether the "mechanism behind the bleeding

[was] traumatic," meaning involving "acceleration/deceleration and rotational and shearing forces." Id. at 1127, 1129.

During the hearing, the experts also referred to numerous articles citing the special significance of retinal hemorrhages to a SBS/AHT diagnosis. For example, Medina referred to a statement by the American Academy of Ophthalmology, explaining that "[t]he most common ocular manifestation of a shaking injury, present in approximately 85% of cases, is retinal hemorrhages." Alex V. Levin et al., Abusive Head Trauma/Shaken Baby Syndrome, (Statement by the American Academy of Ophthalmology), at 1 (2015).

The Statement noted that retinal hemorrhages can be found in the different layers of the retina, and "tend to be concentrated in or near the posterior pole, but frequently are so extensive that they occupy nearly the entire fundus." Id. at 2. The statement cited the vitreoretinal traction theory to explain how such retinal hemorrhages are caused. Id. at 3. The theory posited that the "repetitive acceleration-deceleration forces with or without head impact" from shaking caused hemorrhaging, noting that "[t]he well-formed vitreous of infants and young children is very firmly attached to retinal blood vessels, the peripheral retina and the macula." Ibid.

Despite the vitreoretinal traction theory's acceptance by pediatric ophthalmologists and the child abuse community, Scheller disagreed that a specific pattern of hemorrhages was only associated with SBS/AHT, stating it was never corroborated in laboratory studies involving animals and mechanical models and noting that the reporting doctors were trained to treat and diagnose such issues, not to determine their cause. He concluded that the concept of a specific pattern of retinal hemorrhages had "no foundation in science or in . . . well done research."

Following the hearing, Judge Jimenez issued an order and lengthy written decision barring evidence concerning SBS/AHT. After summarizing the testimony at the hearing, the judge applied the governing principles and concluded that SBS/AHT evidence was not reliable. First, the judge found that a SBS/AHT diagnosis required expert testimony pursuant to N.J.R.E. 702, inasmuch as it was "outside the knowledge of the average juror." Next, the judge explained that to determine whether a particular methodology is "sufficiently established" to support admissibility, there must be a clear testing method.

However, according to the judge, with SBS/AHT, there was no test "that could support a finding that humans can produce the requisite physical force necessary to produce the symptoms in an infant associated with [SBS/]AHT."

The judge noted that, in a sense, a SBS/AHT diagnosis was not made based upon the same type of clinical findings as other diagnoses. Instead, "[i]t [was] made by way of a process of elimination involving medical testing to assess and/or eliminate possible causes of the triad of injuries associated with [SBS/]AHT," with SBS/AHT as the "final option" once all other possibilities were eliminated. Thus, the judge found that SBS/AHT was "more conjecture than a diagnosis because it [was] an option embraced once a diagnostician runs out of diagnostic options."

The judge pointed out that, starting with the Ommaya study in 1968, studies have attempted to determine the injury threshold—meaning the level of force—necessary to generate intracranial trauma in the test surrogates, be it animals, computerized models, or various anthropomorphic devices, such as crash test dummies. The judge explained that not only were these findings "so diverse that no consensus [could] be reached concerning the injury threshold for intracranial injury in infants," the studies also were not validated in terms of how they represented injury to real infant brains, "given how different [an infant brain was] from any other models tested."

The judge concluded that "no study has ever validated the hypothesis that shaking a child can cause the triad of symptoms associated with [SBS/]AHT," and likened the theory to "junk science," given the lack of

testing. Thus, the judge found that "[SBS/]AHT is a flawed diagnosis because it originates from a theory based upon speculation and extrapolation instead of being anchored in facts developed through reliable testing."

The judge also found that the theory, in and of itself, was prejudicial because it "evoke[d] a sense of horror that affect[ed] the sensibilities of any competent juror," undermining the jurors' ability to fairly weigh the evidence. Given the prejudicial nature of the evidence, the judge concluded that SBS/AHT testimony was not admissible "unless it [was] coupled with physical evidence that an accused subjected the infant-victim to some impact of physical trauma that would support holding the accused criminally liable."

II.

These ensuing appeals followed. In the Nieves appeal, the State raises the following points for our consideration:

> POINT I
>
> THE TRIAL COURT MISAPPLIED N.J.R.E. 702 AND THE FRYE TEST IN BARRING EXPERT TESTIMONY ON ABUSIVE HEAD TRAUMA (AHT) AS UNRELIABLE; THE STATE PROVIDED AMPLE EVIDENCE OF THE DIAGNOSIS'S GENERAL ACCEPTANCE IN THE RELEVANT SCIENTIFIC COMMUNITY.
>
> > A. The State Established AHT's General Acceptance as A Diagnosis Through Expert Testimony.

B. The State Established AHT's General Acceptance as A Diagnosis Through Authoritative Scientific And Legal Writings.

C. The State Established AHT's General Acceptance as A Diagnosis Through Judicial Opinions.

D. The Reasons Cited by The Trial Court Do Not Justify Exclusion of Dr. Medina's Testimony.

POINT II

THE TRIAL COURT'S ORDER DISMISSING THE INDICTMENT MUST BE REVERSED BECAUSE IT WAS BASED ON THE COURT'S ERRONEOUS EXCLUSION OF EXPERT TESTIMONY ON AHT AND BECAUSE THERE IS SUFFICIENT EVIDENCE OF DEFENDANT'S GUILT WITHOUT THE EXCLUDED TESTIMONY.

In the Cifelli appeal, the State raises the following points for our consideration:

POINT I

THE TRIAL COURT'S ORDER BARRING TESTIMONY ON ABUSIVE HEAD TRAUMA (AHT) MUST BE REVERSED BECAUSE IT RESTED ON AN IMPERMISSIBLE AND ERRONEOUS BASIS.

POINT II

JUDGE JIMENEZ MISAPPLIED N.J.R.E. 702 AND THE FRYE TEST IN BARRING EXPERT TESTIMONY ON ABUSIVE HEAD TRAUMA

(AHT) AS UNRELIABLE IN STATE V. NIEVES, WHERE THE STATE PROVIDED AMPLE EVIDENCE OF THE DIAGNOSIS'S GENERAL ACCEPTANCE IN THE RELEVANT SCIENTIFIC COMMUNITY, AND JUDGE BUCCA ERRED BY ADOPTING JUDGE JIMENEZ'S FINDINGS IN STATE V. NIEVES.

A. The State Established AHT's General Acceptance as A Diagnosis Through Expert Testimony.

B. The State Established AHT's General Acceptance as A Diagnosis Through Authoritative Scientific Legal Writings.

C. The State Established AHT's General Acceptance as A Diagnosis Through Judicial Opinions.

D. The Reasons Cited by Judge Jimenez Do Not Justify Exclusion of Dr. Medina's Testimony.

In the Nieves appeal, we granted motions to appear as amici curiae and participate in oral argument in support of Nieves's position to the following individuals and entities: (1) Lindsay "Dutch" Johnson, Ph.D., Ken Monson, Ph.D., and Kirk Thibault, Ph.D., D-IBFES, three biomechanical engineers; (2) the Innocence Network and the Center for Integrity in Forensic Sciences; and (3) Dr. Jacob Andersson, Prof. Anders Eriksson, Dr. Patrick Hamel, Dr. Ulf Hogberg, Dr. Lawrence Hutchins, Prof. Niels Lynoe, Dr. David Ramsay, Dr.

Cyrille Rossant, Dr. Guillaume Sebire, Dr. Dale Vaslow, and Dr. Knut Wester, a group of eleven medical physicians.

III.

We first review the State's challenge to Judge Jimenez's ruling on the reliability and admissibility of SBS/AHT testimony. Whether expert scientific evidence is sufficiently reliable under the Frye test to be admissible under N.J.R.E. 702 is a legal question that we review de novo. Rochat, 470 N.J. Super. at 436. In our review, we "independently scrutinize the record, including the comprehensive and amplified declarations of the experts, the scientific validation studies and peer-reviewed publications, and judicial opinions." State v. Pickett, 466 N.J. Super. 270, 303 (App. Div. 2021).

Pursuant to N.J.R.E. 702, "[i]f 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 by knowledge, skill, experience, training, or education may testify thereto in the form of an opinion or otherwise." To satisfy the rule, the proponent of expert evidence must establish that: (1) the subject matter of the testimony is "beyond the ken of the average juror"; (2) the field of inquiry is "at a state of the art such that an expert's testimony could be sufficiently reliable"; and (3) the witness has

"sufficient expertise" to offer the testimony. State v. J.L.G., 234 N.J. 265, 280 (2018) (quoting State v. Kelly, 97 N.J. 178, 208 (1984)).

The issue challenged in these appeals is the second query—whether SBS/AHT is a reliable scientific theory. Our assessment of the scientific reliability of the SBS/AHT theory is governed by the Frye standard. Under that standard, "[s]cientific test results are admissible in a criminal trial only when the technique is shown to be generally accepted as reliable within the relevant scientific community." State v. Cassidy, 235 N.J. 482, 491-92 (2018). "That is to say, the test must have a 'sufficient scientific basis to produce uniform and reasonably reliable results and will contribute materially to the ascertainment of the truth.'" State v. Pittman, 419 N.J. Super. 584, 592 (App. Div. 2011) (quoting State v. Chun, 194 N.J. 54, 91 (2008)).

> "Proof of general acceptance within a scientific community can be elusive," and "[s]atisfying the test involves more than simply counting how many scientists accept the reliability of the proffered [technique]." General acceptance "entails the strict application of the scientific method, which requires an extraordinarily high level of proof based on prolonged, controlled, consistent, and validated experience."
>
> [Cassidy, 235 N.J. at 492 (alterations in original) (citation omitted) (quoting State v. Harvey, 151 N.J. 117, 171 (1997)).]

"The proponent of the technique has the burden to 'clearly establish' general acceptance." Ibid. (quoting State v. Johnson, 42 N.J. 146, 171 (1964)). "[T]here are three ways to establish general acceptance under Frye: expert testimony, authoritative scientific and legal writings, and judicial opinions." J.L.G., 234 N.J. at 281. Establishing general acceptance of a scientific theory through judicial opinions may include decisions from other jurisdictions, but it is "unusual for an appellate court to rely exclusively on judicial notice." State v. Doriguzzi, 334 N.J. Super. 530, 539 (App. Div. 2000) (citing Ferlise v. Eiler, 202 N.J. Super. 330, 335 (App. Div. 1985)). In Doriguzzi, 334 N.J. Super. at 540, we expressed caution on relying solely on judicial opinions, in part due to the different standards and considerations other jurisdictions employ, but also the need to have "reliable scientific data" when determining a novel issue. Ibid.

To support admissibility, the State cites two New Jersey cases where SBS/AHT testimony was deemed admissible. In State v. Compton, we determined that SBS/AHT evidence was admissible because: (1) the State's expert testified that the theory "was generally accepted both as descriptive of a condition and as a diagnosis"; (2) "the condition has been adequately analyzed and recognized in medical research and literature"; and (3) other jurisdictions

have explicitly or implicitly recognized the theory. 304 N.J. Super. 477, 485-86 (App. Div. 1997).

In Compton, we cited State v. Galloway, 133 N.J. 631, 637-38 (1993), where the defendant was convicted of murder based on SBS/AHT evidence after admitting to shaking a three-month-old infant hard several times. Compton 304 N.J. Super. at 486. We noted that our Supreme Court had "recognized the condition implicitly, by acknowledging expert testimony describing the syndrome in connection with a particular case at bar, or treating it as an accepted medical condition without further comment." Ibid. (citing Galloway, 133 N.J. at 638). However, given the age of Compton and Galloway, and the change in the scientific community's view about SBS/AHT evidence, continued adherence to these cases is neither prudent nor pragmatic. See J.L.G., 234 N.J. at 281-83 (revisiting the admissibility of CSAAS testimony despite finding it admissible twenty-five years earlier); State v. Moore, 188 N.J. 182, 207-08 (2006) (holding that hypnotically refreshed testimony "cannot meet the general acceptance standard of admissibility" despite being deemed admissible twenty-five years earlier).

There is a dearth of recent New Jersey cases challenging the admissibility of SBS/AHT testimony. See State v. Blakney, 389 N.J. Super. 302, 312, 316 (App. Div. 2006), rev'd on other grounds, 189 N.J. 88 (2006)

(noting no objection to the admission of SBS/AHT testimony where the victim-infant's treating pediatrician and an expert in forensic pathology both attributed the victim-infant's injuries to SBS/AHT). We acknowledge, however, that "[g]eneral acceptance within the relevant scientific community consists of more than just counting up how many cases go in a certain direction." Doriguzzi, 334 N.J. Super. at 546.

As to out-of-state judicial support, the State relies on a number of SBS/AHT cases, of which only a limited number expressly determined the admissibility of SBS/AHT evidence under Frye. Others either determined admissibility under a different standard or did not actually decide the question of admissibility of SBS/AHT as a theory. See State v. Stewart, 923 N.W.2d 668, 676 (Minn. Ct. App. 2019) (finding that SBS/AHT was "reliable" as a theory and therefore admissible based on the State's representation that this was an "accepted" diagnosis); Sissoko v. State, 182 A.3d 874, 898, 906 (Md. Ct. Spec. App. 2018) (applying the "Frye-Reed" standard to determine that a diagnosis of SBS/AHT, absent external findings, remained a generally accepted diagnosis in the medical community); State v. West, 551 S.W.3d 506, 516-17 (Mo. Ct. App. 2018) (determining there was no error in admitting expert testimony as the dispute about SBS/AHT could be examined during cross-examination); In re Morris, 355 P.3d 355, 360-61 (Wash. Ct. App. 2015)

(discussing the admissibility of SBS/AHT testimony in the context of an ineffective assistance of counsel challenge and determining that the testimony was admissible based on articles from various medical organizations supporting the theory); State v. McClary, 541 A.2d 96, 102 (Conn. 1988) (upholding the admissibility of SBS/AHT testimony under Frye from thirty-five years ago with no experts disputing the theory); People v. Flores-Estrada, 51 N.Y.S.3d 863, 864-65 (N.Y. Sup. Ct. 2017) (relying on submitted scientific evidence and prior caselaw to decline to hold a Frye hearing to determine the admissibility of SBS/AHT testimony and explaining that any dispute about the theory can be adduced through cross-examination and the presentation of defense experts).

In contrast, Nieves cites a number of out-of-state cases to support his position that SBS/AHT is no longer generally accepted, but none of the cases involved the courts' express consideration of the admissibility of SBS/AHT evidence under Frye. Two of the cases involved vacating the defendants' convictions where the change in view of SBS/AHT evidence constituted "newly discovered evidence." See State v. Edmunds, 746 N.W. 2d 590, 599 (Wisc. Ct. App. 2008) (citing the newly discovered evidence as a "shift in mainstream medical opinion" about whether shaking alone can cause death, whether babies can experience a "lucid interval" following intracranial trauma,

and whether "other causes may mimic the symptoms" associated with SBS/AHT); People v. Bailey, 999 N.Y.S.2d 713, 723-27 (N.Y. Cnty. Ct. 2014) (vacating conviction and remanding for a new trial based on a "significant change in medical science" about SBS/AHT, particularly in connection with biomechanical studies that questioned causation, and studies about how short falls can cause injuries associated with SBS/AHT), aff'd, 41 N.Y.S.3d 625 (N.Y. App. Div. 2016).

"Reliance upon other courts' opinions can be problematic . . . '[u]nless the question of general acceptance has been thoroughly and thoughtfully litigated in the previous cases . . . ." Doriguzzi, 334 N.J. at 545 (quoting People v. Kirk, 681 N.E.2d 1073, 1077 (Ill. App. Ct. 1997)). Although "[a] long line of decisions uniformly in favor of a legal proposition suggests that a legal proposition is generally accepted[,] . . . . [w]e are mindful, however, that in science, the repetition of authority does not automatically establish reliability for purposes of a Frye hearing." Pickett, 466 N.J. Super. at 307. Indeed, some of the cases cited by the State confirmed the reliability of SBS/AHT based on a prior court's acceptance of SBS/AHT, a type of circularity that is inappropriate given Nieves's position that the medical and scientific community's view about SBS/AHT has evolved over time, warranting a new review of the issue.

To establish general acceptance of a scientific theory, "the party proffering the evidence need not show infallibility of the technique nor unanimity of its acceptance in the scientific community." Cassidy, 235 N.J. at 492. Rather, the party must demonstrate that the "test and the interpretation of its results are non-experimental, demonstrable techniques that the relevant scientific community widely, but perhaps not unanimously, accepts as reliable." State v. Ghigliotty, 463 N.J. Super. 355, 383 (App. Div. 2020) (quoting Harvey, 151 N.J. at 171).

To be sure, "[g]eneral acceptance is not an end in itself," but a way to evaluate whether there is "a sufficient level of reliability" lying beneath the expert testimony to "allow consideration . . . by the factfinder." Doriguzzi, 334 N.J. Super. at 546. Critically, where, as here, the underlying theory "integrates multiple scientific disciplines," then "there might be more than one scientific community to consider," and the proponent must establish "cross-disciplinary validation to determine reliability." Pickett, 466 N.J. Super. at 302, 323. Still,

> "[w]hat constitutes reasonable reliability depends in part on the context of the proceedings involved." Admissibility of the evidence
>
> > entails a weighing of reliability against prejudice in light of the context in which the evidence is offered. Expert evidence that poses too great a danger of prejudice

> in some situations, and for some purposes, may be admissible in other circumstances where it will be more helpful and less prejudicial.
>
> [In re Commitment of R.S., 339 N.J. Super. 507, 539 (App. Div. 2001) (citation omitted) (quoting State v. Cavallo, 88 N.J. 508, 520 (1982)).]

SBS/AHT is a multidisciplinary diagnosis based on the theory that vigorously shaking an infant—with or without impact—creates such great rotational acceleration and deceleration forces that result in a constellation of symptoms that may not manifest externally. Whether SBS/AHT theory is generally accepted within the medical and scientific community requires evaluation of two considerations: (1) whether the theory is generally accepted by the biomechanical community and supported by biomechanical testing; and (2) whether the theory is generally accepted by the pediatric medical community and supported by the clinical data connecting the constellation of symptoms with SBS/AHT.

Although the State has demonstrated general acceptance in the pediatric community, we agree with Judge Jimenez that the State has not demonstrated general acceptance of the SBS/AHT hypothesis to justify its admission in a criminal trial. On the contrary, the evidence amply demonstrates that there is no general acceptance from the biomechanical community, and biomechanical testing has never proven the premise of SBS/AHT, despite the hypothesis

being grounded in biomechanical principles. Although Medina was dismissive of the dispute within the biomechanical community, all the experts at the hearing agreed that, at the very least, there was "controversy" surrounding whether the biomechanical theory behind SBS/AHT actually supported the conclusion that shaking alone can cause the injuries associated with SBS/AHT. Indeed, the State failed to submit any biomechanical study that was able to confirm the theories set forth by Caffey and Guthkelch, that shaking alone can create acceleration and deceleration forces sufficient to cause intracranial trauma.[14]

Although unanimity of view is not a prerequisite to satisfying the general acceptance and reliability standard, Ghigliotty, 463 N.J. Super. at 383, the dispute runs deeper than diversity in view and goes to the very foundation of the SBS/AHT hypothesis. One cannot conclude that SBS/AHT is "state of the art," J.L.G. 234 N.J. at 280 (quoting Kelly, 97 N.J. at 208), when the very basis of the theory has never been proven. Without a biomechanical study supporting SBS/AHT, it remains a hypothesis without "uniform and reasonably

[14] Significantly, amicus curiae Medical Physicians cited a recent article by Guthkelch—which was not provided to the trial court or on appeal—wherein Guthkelch acknowledged that biomechanical tests could not reach the injury thresholds from shaking alone. A.N. Guthkelch, Problems of Infant Retino-Dural, Hemorrhage with Minimal External Injury, 12 House. J. Health L. & Pol'y 201, 202-03 (2012).

reliable results" from which to ascertain the truth. Pittman, 419 N.J. Super. at 592 (quoting State v. Hurd, 86 N.J. 525, 536 (1981), abrogated on other grounds by State v. Moore, 188 N.J. 182 (2006)). It also fails to show that "the interpretation of its results are non-experimental, demonstrable techniques," which can be accepted as reliable. Ghigliotty, 463 N.J. Super. at 383 (quoting Harvey, 151 N.J. at 171). It therefore does not satisfy the "extraordinarily high level of proof" necessary to constitute general acceptance. Cassidy, 235 N.J. at 492 (quoting Harvey, 151 N.J. at 171). Because biomechanical theory is the foundation of the SBS/AHT hypothesis, the lack of biomechanical support renders the theory scientifically unreliable, notwithstanding its support in the pediatric community. We therefore affirm Judge Jimenez's decision precluding the testimony at trial.

IV.

We next turn to the State's challenge to Judge Jimenez's dismissal of Nieves's indictment. Following the Frye ruling, Nieves moved to dismiss the indictment, arguing that the only evidence against him was Medina's testimony that D.J.'s symptoms were due to SBS/AHT. The State opposed the motion, contending that while Medina could no longer testify about the symptoms associated with SBS/AHT, she could testify "as to the symptoms presented by D.J., the undisputed fact that shaking with impact [could] cause those

symptoms," and that she ruled out any possible causes for D.J.'s symptoms. The judge granted Nieves' motion and dismissed the indictment without prejudice on the ground that there was "insufficient evidence to prove causation." The judge reasoned that because Medina would not be able to explain causation or "the source of the trauma," the jury would have "to speculate" about what happened.

We review a trial court's decision on a motion to dismiss an indictment for abuse of discretion. State v. Bell, 241 N.J. 552, 561 (2020) (citing State v. Twiggs, 233 N.J. 513, 544 (2018)). Under that deferential standard, "the trial court's 'decision should be reversed on appeal only [if] it clearly appears that the exercise of discretion was mistaken.'" Ibid. (alteration in original) (quoting State v. Abbati, 99 N.J. 418, 436 (1985)). "The absence of any evidence to support the charges would render the indictment 'palpably defective' and subject to dismissal." State v. Morrison, 188 N.J. 2, 12 (2006) (citing State v. Hogan, 144 N.J. 216, 228-29 (1996)). "A trial court, however, should not disturb an indictment if there is some evidence establishing each element of the crime to make out a prima facie case." Ibid.

Contrary to the State's contention, without SBS/AHT testimony, there was insufficient evidence to support the indictment against Nieves. The elements of aggravated assault pursuant to N.J.S.A. 2C:12-1(b)(1) required

proof of an attempt "to cause serious bodily injury to another," or proof that defendant caused such injury "purposely or knowingly or under circumstances manifesting extreme indifference to the value of human life recklessly cause[d] such injury." The elements of endangering the welfare of a child pursuant to N.J.S.A. 2C:24-4(a)(2) required proof that defendant: (1) had "a legal duty for the care of a child," and (2) harmed the child, such that the child would qualify as an "abused or neglected" child under the law.

Without SBS/AHT testimony, the State cannot demonstrate a necessary element of both offenses – that Nieves caused D.J. harm. Although the State could present testimony that D.J. was in Nieves's care when D.J. had his episodes of limpness, and that he was found to have retinal hemorrhages and subdural hematomas, the State would not be able to explain how Nieves harmed D.J., leaving the question for the jury to determine. Although a jury may draw a reasonable inference from the facts presented, "the State's right to the benefit of reasonable inferences should not be used to shift or lighten the burden of proof, or become a bootstrap to reduce the State's burden of establishing the essential elements of the offense charged beyond a reasonable doubt." State v. Brown, 80 N.J. 587, 592 (1979). "Speculation, moreover, cannot be disguised as a rational inference." State v. Lodzinski, 249 N.J. 116, 144-45 (2021). "An accused 'may not be condemned upon surmise, conjecture

or suspicion.'" Id. at 145 (quoting State v. LaFera, 42 N.J. 97, 119 (1964)). Requiring the jury to infer that Nieves harmed D.J. would require the jury to make such a leap.

V.

In the Cifelli appeal, the State argues that it never agreed to be bound by Judge Jimenez's Frye ruling in Nieves, and Judge Bucca thus erred in adopting that decision as the basis to bar SBS/AHT testimony in the Cifelli case without making his own findings. The divergent positions of the parties regarding the impact of Judge Jimenez's Frye ruling on the Cifelli matter and their agreement in that regard were manifested in certifications submitted by the respective attorneys reflecting their respective recollection of the events leading up to the agreement.[15] Defense counsel maintained that the parties would be bound by Judge Jimenez's Frye ruling while the State denied any agreement to be bound by Judge Jimenez's decision.

Following oral argument conducted on March 29, 2022, Judge Bucca entered an order dated March 31, 2022, finding that the parties "agreed to be bound by the ruling on the admissibility of abusive head trauma testimony" in the Nieves matter. Pursuant to the agreement, the judge granted Cifelli's

[15] At least four different prosecuting attorneys were assigned to the Cifelli matter during the relevant time period.

motion to bar SBS/AHT testimony, "with th[e] court incorporating the findings" made by Judge Jimenez in the Nieves matter.

In his supporting oral decision, Judge Bucca recounted the procedural overlap between both cases and stated "there [was] no doubt in th[e c]ourt's mind that it was agreed between the parties that the decision by Judge Jimenez as to the admissibility of the expert testimony on abusive head trauma would be binding . . . on the Cifelli case." The judge explained that his "recollection [was] clear" due to the unique characteristics of the dual proceedings. The judge noted that "[i]n hindsight, it would have been better that we memorialized this agreement by way of an order," but the lack of an order "should not undermine th[e c]ourt's clear recollection as to the understanding between the parties."

Because our disposition in the Nieves appeal resolves the admissibility of SBS/AHT testimony under Frye, regardless of the propriety of a trial court's decision to be bound by another court's ruling in these circumstances,[16] we deem Judge Bucca's decision to defer to Judge Jimenez's Frye ruling moot. "An issue is 'moot when our decision sought in a matter, when rendered, can

[16] Cf. State v. Gibson, 219 N.J. 227, 240-41, 248 (2014) (cautioning against a common practice in municipal courts of incorporating testimony from the suppression hearing into the trial record and warning "that 'the interest in judicial economy cannot override a defendant's right to a fair trial.'" (quoting State v. Brown, 170 N.J. 138, 160 (2001))).

have no practical effect on the existing controversy.'" Redd v. Bowman, 223 N.J. 87, 104 (2015) (quoting Deutshe Bank Nat'l Tr. Co. v. Mitchell, 422 N.J. Super. 214, 221-22 (App. Div. 2011)). In other words, "a case is moot if the disputed issue has been resolved[.]" Enron (Thrace) Expl. & Prod. v. Clapp, 378 N.J. Super. 8, 13 (App. Div. 2005) (quoting Caput Martuum v. S. & S., 366 N.J. Super. 323, 330 (App. Div. 2004)).

Because we have resolved the scientific reliability and admissibility of SBS/AHT testimony, our holding must be accorded conclusive weight. See, e.g., State v. Rose, 206 N.J. 141, 183 (2011) ("[T]he legal findings and determinations of a high court's considered analysis must be accorded conclusive weight by lower courts."); Caldwell v. Rochelle Park Twp., 135 N.J. Super. 66, 76 (Law Div. 1975) ("[A] trial court is bound to follow the rulings of an appellate court in this State, which decisions are binding when the same issues are presented."). Based on our decision, we need not address the remaining arguments.

Affirmed.