SUPERIOR COURT OF NEW JERSEY
APPELLATE DIVISION
DOCKET NO. A-2069-21T4

	:	CRIMINAL ACTION
STATE OF NEW JERSEY,	:	On Appeal from a Final Order of the Superior Court of
Plaintiff-Appellant,	:	New Jersey, Law Division,
v.	:	Middlesex County.
DARRYL NIEVES,	:	Ind. No. 17-06-785-I
Defendant-Respondent.	:	Sat Below:
	:	Hon. Pedro J. Jimenez, Jr., J.S.C.

BRIEF AND APPENDIX ON BEHALF OF DEFENDANT-RESPONDENT

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DEFENDANT IS NOT CONFINED

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PRELIMINARY STATEMENT

The State bore the burden of proving that the Shaken Baby Syndrome (SBS), also known as Abusive Head Trauma (AHT) by shaking, is clearly reliable in all relevant scientific communities. The motion court found that the State failed to meet this burden because it did not provide any reliable evidence showing that humans can shake children with force sufficient to cause bleeding in the brain, severe bleeding in the eyes, and neurological impairment, all without causing any other injuries. The court explained its reasoning in a thorough seventy-five-page opinion after hearing from four expert witnesses and reviewing significant scientific and legal authority.

The State argues that this ruling was mistaken based on multiple claimed errors, including misidentification of the relevant scientific community, failure to account for persuasive evidence, and even errors regarding credibility determinations. These arguments, however, lack necessary context, rely on misunderstandings of the record, and, most basically, repeatedly fail to explain how the shaking-only theory is possible. They should therefore be rejected.

First, the State conflates AHT as an overarching concept -- that is, that children can suffer head trauma from abuse -- with AHT by shaking. AHT by shaking, however, is a specific subset of AHT for which reliability must be

established. Demonstrating the basic fact that children can suffer head trauma from abuse does not prove that AHT by shaking itself is generally accepted.

Second, the State paradoxically argues that the court erred in considering the field of biomechanics but does not dispute that the shaking theory is rooted in biomechanics or that biomechanical research has consistently undermined that theory. Specifically, study after study has shown that shaking without impact cannot cause the injuries associated with AHT and that, even if enough force could be created, it would also result in neck injuries inconsistent with the theory. General acceptance cannot be found in the face of such research.

Third, the State claims to have established reliability as a medical matter but does not defend the unvalidated theories that its expert relied upon or cite to any other reliable theories as to how AHT by shaking can occur. Instead, the State relies on studies of confessed or witnessed shaking, but those studies do not explain how AHT by shaking is possible, suffer from numerous methodological shortcomings, and have resulted in inconsistent findings. Thus, they also cannot establish general acceptance and scientific reliability.

The State also argues that reliability can be found based on judicial opinions. Little, however, can be gleaned from the opinions cited by the State, as they were based on limited records, applied more permissive standards, or failed to address the key issue of causation, and because they are undermined

by other opinions casting doubt or even excluding AHT by shaking testimony. Additionally, the State's remaining claimed errors regarding the motion court's opinion are either misplaced, or irrelevant to the issue of reliability.

Thus, the State's arguments do not call for disturbing the motion court's ruling, such that affirmance should be ordered and the testimony excluded.

COUNTERSTATEMENT OF PROCEDURAL HISTORY

On June 30, 2017, a Middlesex County Grand Jury charged Darryl Nieves in indictment number 17-06-785-I with second-degree aggravated assault, N.J.S.A. 2C:12-1b(1), and second-degree endangering the welfare of a child, N.J.S.A. 2C:24-4a(2). (Pa 1)[2] On July 2, 2018, Nieves moved for an N.J.R.E. 104(a) Frye[3] hearing to determine the admissibility of expert testimony regarding Shaken Baby Syndrome (SBS), or Abusive Head Trauma (AHT) by shaking.[4] (Pa 7) On November 2, 2018, the Honorable Pedro J. Jimenez, Jr., J.S.C., granted Nieves's motion. Ibid. On September 11, 2019,

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[2] Nieves adopts the record designations used by the State and adds the following:

Da = Appendix to defendant-respondent's response brief
Pb = State's opening brief
11T = Transcript of grand jury proceeding - June 23, 2017

[3] Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).

[4] In addition to the terms SBS and AHT by shaking, the diagnosis is also sometimes referred to as shaking-only AHT and AHT without impact.

the court granted the State's motion for reconsideration. Ibid. On October 29, this Court granted leave to appeal and remanded for a Frye hearing. (Pa 79)

The Frye hearing was held over five days in September and October 2020. (4T; 5T; 6T; 7T; 8T) On January 7, 2022, Judge Jimenez issued an order and written opinion excluding testimony about AHT by shaking. (Pa 2-78) Judge Jimenez also denied the State's motion for a stay and gave it until January 28 to address Nieves's motion to dismiss the indictment. (Pa 81-82; 9T7-13 to 10-22) The State filed a response to the dismissal motion on January 20 and a motion for reconsideration on January 27. (Pa 83-85) Argument was held on January 28, after which Judge Jimenez denied the State's motion for reconsideration and dismissed the indictment. (Pa 86-87; 10T)

On March 14, the State filed a notice of appeal, as well as motions for leave to appeal the Frye ruling as within time. (Pa 118-22) On April 1, this Court granted the State's motions and denied Nieves's motion to dismiss the notice of appeal. (Pa 123-26)

COUNTERSTATEMENT OF FACTS

I. D.J.'s Complicated Medical History & Diagnosis

The charges in this case arose from a February 10, 2017, emergency room visit for D.J.,[5] the then-eleven-month-old son of Darryl Nieves and Lucy

[5] Nieves adopts the State's use of pseudonyms pursuant to Rule 1:38-3(c)(9).

[redacted] (Pa 3-4) Unfortunately, the family was no stranger to hospital visits due to the many serious and complex medical conditions D.J. faced. D.J. had been born at twenty-five weeks gestation, through emergency caesarian section, on March 9, 2016. (Pa 3) D.J. survived the birth but experienced a plethora of medical issues due to his extreme prematurity, including with his eyes, respiratory system, digestive tract, and development. (Pa 4)

D.J. also suffered from a heart condition that required two cardiac surgeries and which resulted in him remaining in hospital care for the first seven months of his life. Ibid. D.J. continued to require intense medical care upon his release in October 2016. This included oxygen administration, regular visits to multiple specialists, and well-regulated feeding and medication schedules. Ibid. After [redacted] returned to work, Nieves stayed home to care for D.J. and [redacted] older child, who was also born premature. Ibid.

On February 3, 2017, D.J. went limp and passed out while Nieves was changing his diaper. Ibid. Nieves and [redacted] called an ambulance but D.J.'s symptoms resolved by the time it arrived. Ibid. The next day, Nieves and [redacted] brought D.J. to his pediatrician, who stated that the symptoms could be related to D.J.'s respiratory or digestive conditions. (Pa 4-5) A few days later, D.J. again went limp and seemed to lose consciousness while Nieves was changing his diaper, but recovered after Nieves administered him oxygen. (Pa 5) Finally,

on February 10, Nieves found D.J. tightening his jaw and appearing unresponsive in his bassinet. Ibid. Nieves called 911 and brought D.J. to [redacted] who took a video of D.J.'s symptoms. Ibid. D.J.'s symptoms resolved after paramedics administered oxygen and brought him to St. Peter's University Hospital. Ibid.

Once at the hospital, doctors performed scans of D.J.'s head, which resulted in the discovery of new and old subdural hemorrhages, meaning bleeding in the brain. Ibid. An eye exam revealed retinal hemorrhages in both eyes. Ibid. Because neither [redacted] nor Nieves reported D.J. suffering any accidental injuries, Dr. Gladibel Medina, a child abuse pediatrician, was contacted to determine whether the injuries were from abuse. (Pa 5-6) Dr. Medina ultimately diagnosed D.J. with "abusive head trauma, as occurs with a shaking event with or without impact." (Pa 6) Dr. Medina made this diagnosis even though D.J. had no signs of impact, or any fractures, bruising, or neck injuries. (4T162-17 to 165-16, 170-22 to 171-19; 5T10-7 to 9)

Nieves denied harming D.J. and [redacted] similarly told the police that she never saw Nieves hurt D.J. (Pa 6) Nonetheless, Nieves was charged with abusing D.J., and was prohibited from seeing his children. Ibid.

II. The Frye Hearing

Nieves filed a motion challenging the admissibility of Dr. Medina's diagnosis based on the lack of reliability of SBS or AHT by shaking.[6] (Pa 7) An evidentiary hearing was held over five days in September and October 2020. (4T; 5T; 6T; 7T; 8T) During the hearing, the State presented the testimony of one witness -- Dr. Medina -- while Nieves presented expert testimony from a pediatric neurologist, a radiologist, and a biomechanist.

A. Dr. Gladibel Medina

The State's sole witness was Dr. Medina. Dr. Medina is the medical director of the Dorothy B. Hersh Regional Child Protection Center at St. Peter's University Hospital and testified as an expert in the fields of pediatrics and child abuse pediatrics. (4T8-9 to 16-5, 25-24 to 26-16) Dr. Medina testified about AHT as a general concept, how it is diagnosed, and how it relates to multiple scientific fields beyond her expertise, including radiology, neurology, and biomechanics. (4T22-23 to 24-12)

Dr. Medina testified that AHT is a comprehensive term that covers any "inflicted injury of the skull or intracranial contents in an infant or a child under five years" and can be caused by any combination of head injuries, including "crushing," "violent shaking," and "blunt head impact." (4T26-18 to

[6] Nieves also challenged the reliability of Dr. Medina's diagnostic process (Pa 491-510, 527-30), but the motion court did not rule on that issue.

25, 31-17 to 32-14) There is no test or "specific diagnostic criteria" for AHT. (4T113-14 to 20, 158-2 to 6) Rather, doctors consider a broad "spectrum of injuries" associated with AHT, including injuries to the skeletal system, bruising, and mental impairment, and will typically raise a concern for abuse when an injury "does not fit" the child's history or development. (4T27-8 to 28-25, 155-12 to 156-23) No symptom is dispositive, but the more injuries present, the more likely AHT will be diagnosed. (4T156-24 to 160-2 to 5)

Moreover, while all factors should be considered, three factors commonly known as the "triad" are considered more "specific" for AHT: encephalopathy, subdural hematomas, and severe retinal hemorrhages. (4T53-7 to 12, 158-12 to 17) Encephalopathy is the "external presentation of intracranial trauma[,]" such as "unresponsiveness, apnea, seizures, [or] altered mental status[,]" and is the factor that most often "raises a flag for potential inflicted injury." (4T27-25 to 28-15, 43-8 to 9, 53-7 to 12, 72-4 to 9) The second factor, subdural hematoma or hemorrhage (SDH), consists of "bleeding under the dural membrane," the outermost membrane surrounding the brain. (4T46-19 to 48-11, 53-13 to 19) The third factor, severe retinal hemorrhage (RH), is drops of blood in the eye's three retinal layers, extending around the eye, that are "too numerous to count." (4T55-15 to 57-12, 58-7 to 20)

Because it is considered "more specific" for abuse, the presence of the triad will trigger additional investigation, often by a child abuse pediatrician (CAP). (4T30-10 to 15, 52-9 to 53-4) This investigation involves an evaluation of the child's condition and medical history as well as "consultation with multiple subspecialties" to determine whether any other "pathology or medical issues . . . might be contributing to" the condition. (4T29-8 to 30-9, 54-1 to 22, 113-25 to 115-21) Following this review, the CAP will diagnose AHT unless the triad can be explained by something other than abuse. (4T72-10 to 73-10) In other words, the triad creates a "probability" of abuse that, absent an alternative explanation, becomes a "final diagnosis." (5T54-12 to 55-12)

Dr. Medina opined that this diagnostic method is "widely accepted" and that the premise underlying AHT -- that "children can sustain intracranial injuries" from abuse -- has been accepted for "about 160 years." (4T30-19 to 31-1, 32-15 to 34-15, 73-24 to 74-9) At the same time, however, Dr. Medina conceded that there have been "challenge[s]" to the "mechanism of shaking" and whether it can cause the triad symptoms. (4T34-7 to 11)

As Dr. Medina admitted, the theory that shaking can cause intracranial injury without "external signs of trauma" is relatively new and was known as SBS until the term AHT was adopted in 2009.[7] (4T31-2 to 32-14) SBS was

[7] A more detailed discussion of the history of SBS can be found at Pa 447-63.

based on a 1968 biomechanical[8] study by Dr. Ayub Ommaya in which monkeys were found to have "concussion[s] in addition to small bruises and subdural bleeds" after "a single cycle whiplash event." (4T34-15 to 35-18) "This study established the injury thresholds for intracranial injury" and "what we know about shaking" as a mechanism for injury. (4T34-21 to 25, 35-18 to 20, 36-11 to 18) However, as Dr. Medina testified, there is "controversy" surrounding this theory because subsequent biomechanical studies in the intervening half century have shown that, contrary to Dr. Guthkelch's hypothesis, shaking does "not generate enough forces" to cause the triad without impact. (4T35-1 to 39-11, 129-5 to 24, 132-14 to 18)

Nonetheless, Dr. Medina opined that SBS remains a valid theory for two main reasons. First, she testified that the unfavorable biomechanical research should be discounted because its results are too "diverse," the studies too limited, and the injury threshold too unknown for firm conclusions to be drawn. (4T39-12 to 42-25, 166-13 to 168-25) Additionally, Dr. Medina opined that biomechanics is not dipositive because the medical community accepts that shaking can cause the triad based on other, non-biomechanical theories.

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[8] "Biomechanics is the study of biological systems through mechanical principles." MIT, Biomechanics, https://be.mit.edu/research-areas/biomechanics. A more detailed discussion of biomechanics and the biomechanical research concerning the shaking hypothesis can be found at Pa 463-76.

For example, Dr. Medina testified that shaking can cause subdural hematomas by rupturing "bridging veins" that "traverse the surface of the brain." (4T47-17 to 48-19, 169-1 to 15) Yet, as Dr. Medina explained, this theory is based on children with benign enlargement of the subarachnoid space (BESS), a condition that involves a buildup of intracranial fluid that predisposes those children to intracranial bleeding, and the "assumption" that bridging veins can also rupture from shaking children without this condition. (4T45-3 to 10, 47-17 to 51-22, 120-8 to 121-24, 169-10 to 15; 5T53-15 to 54-11) Dr. Medina also testified about "the vitreoretinal traction theory" -- that shaking causes the vitreous, "a jelly-like substance within the eye[,]" to "pull against the retina causing rupture of the retinal veins" that line the walls of the eye -- which she said is "what is felt" to explain how shaking may cause severe retinal hemorrhages.[9] (4T57-5 to 58-6, 67-22 to 68-6; 5T62-14 to 20)

Despite her reliance upon these theories, Dr. Medina had to concede that there was "[n]o study" showing that bridging veins could "tear" in the way she described. (4T169-5 to 25) She also cited no scientific authority to support the vitreoretinal traction theory or her claim that shaking causes hemorrhage "patterns" that are only associated with shaking, "motor vehicle roll-overs," and "certain medical conditions." (4T55-19 to 56-9, 58-2 to 59-23; 5T44-19 to

[9] A more detailed discussion of these theories can be found at Pa 476-85.

24, 58-4 to 59-7) Instead, Dr. Medina claimed support from studies which found high rates of retinal hemorrhages and subdural hematoma in cases of "confessed" shaking. (4T43-20 to 44-24, 68-23 to 71-9, 116-22 to 117-12; 5T59-21 to 62-13) These studies, however, do not explain how shaking causes the triad symptoms.

B. Dr. Joseph Scheller

Dr. Joseph Scheller testified for the defense as an expert in pediatric neurology and neuroimaging. (5T111-1 to 21) Dr. Scheller echoed Dr. Medina's testimony about AHT as a general concept, including that there is "no specific" diagnostic criteria. (5T113-15 to 114-4, 137-23 to 142-1; 8T36-18 to 25) Dr. Scheller also provided a similar recounting of the development of AHT, including the role of biomechanical research. (5T117-22 to 124-18) Dr. Scheller also acknowledged that AHT has been accepted in a general sense, and that shaking may be harmful. (5T130-3 to 11; 8T3-18 to 5-5)

However, Dr. Scheller parted ways with Dr. Medina as to whether there is sufficient evidence to reliably conclude that shaking alone can cause the triad. (5T146-8 to 17) Dr. Scheller opined that the lack of biomechanical validation undermines the reliability of the shaking theory and cannot be dismissed. (5T125-6 to 131-12) Dr. Scheller also testified that the controversy has gone beyond the biomechanical field and that there has also been "a lot

more discussion and criticism" in the medical field in recent years, including rejection of the theory by some doctors. (5T130-16 to 131-12; 8T5-6 to 6-2)

Dr. Scheller was also critical of the non-biomechanical theories and studies relied upon by Dr. Medina. Dr. Scheller testified that the vitreoretinal traction theory has not been scientifically validated and is likely impossible because "the eye moves together with the head[,]" such that the vitreous cannot obtain independent movement. (5T178-20 to 180-15) He also testified that the shaking theory cannot be validated by confession studies because confessions are not medical evidence and are often given under pressure after abuse has been alleged. (5T132-17 to 133-22, 136-9 to 137-5) Dr. Scheller further observed that the confession studies, and SBS diagnoses in general, are affected by circular reasoning in the sense that doctors who observe one part of the triad will suspect abuse and seek out other parts of the triad, without fully considering other causes. (5T133-23 to 134-4, 135-4 to 136-8, 137-6 to 11)

C. Dr. Julie Mack

Dr. Julie Mack testified as an expert in radiology and pediatric radiology. (6T24-16 to 20) Dr. Mack, like the other medical experts, testified that AHT is generally accepted in the sense that children can be abused through head trauma, and that shaking can be harmful. (6T103-22 to 105-1, 126-2 to 12, 130-17 to 21) Dr. Mack also agreed that certain conditions, such

as unexplained subdural hematomas, raise concern for abuse and that the differential diagnosis, or process of elimination, used to diagnose AHT is generally accepted. (6T55-3 to 12, 61-12 to 63-25, 103-3 to 21, 121-7 to 122-1) However, Dr. Mack testified that there is a "heated controversy" over whether shaking can cause the triad and whether observation of the triad can reliably lead to a diagnosis of abuse by shaking. (6T126-13 to 127-8)

Dr. Mack also testified that the concept of different retinal hemorrhage patterns, with some being more associated with abuse, is not generally accepted, and that it is undermined by the presence of similar retinal patterns in other circumstances. (6T96-3 to 7, 122-2 to 124-2) Dr. Mack also noted that the focus on such hemorrhage patterns has been based on studies of diagnosed abuse, thus creating a risk of "confirmatory bias." (6T57-1 to 58-19, 60-7 to 61-8) Additionally, Dr. Mack cast doubt on Dr. Medina's theory that shaking can cause bridging vein rupture, both because "there's no good evidence" to support the theory (6T113-5 to 115-6), and because of the nature of bridging veins. Specifically, Dr. Mack testified that bridging veins are strong and capable of stretching without breaking, and that any rupture would lead to "a surgical emergency" inconsistent with the theory proposed by Dr. Medina. (6T31-6 to 34-7) Dr. Mack also opined that whether shaking can create

sufficient force to cause a rupture would be a question for a biomechanical engineer. (6T115-7 to 116-1)

D. Dr. Chris Van Ee

Dr. Chris Van Ee testified as an expert in biomechanics, which involves "the study of the human body and how it responds to forces or accelerations[,]" including the injuries that may be caused. (7T7-2 to 8-19, 26-5 to 8) As Dr. Van Ee explained, it was biomechanists who first hypothesized that angular acceleration[10] could cause subdural hematoma, and it was this theory that led to the development of the theory that shaking could do so as well. (7T27-2 to 31-23) More specifically, and as Dr. Medina also testified, it was reliance upon the Ommaya whiplash study that led to the hypothesis that shaking "create[s] these angular accelerations of the head that are sufficient to rip bridging veins and cause injury to a child." (7T31-5 to 16, 34-25 to 35-20)

Dr. Van Ee testified that since its inception, this hypothesis has been tested through various biomechanical studies using cadavers, computer models, and crash-test dummies. (7T31-24 to 32-6, 39-25 to 41-9) However, like Dr. Medina, Dr. Van Ee testified that this testing has consistently failed to

[10] Linear acceleration looks at how quickly something starts or stops along a line, while angular acceleration considers something being spun and the force from it being stopped. (7T27-13 to 25) A slow stop will result in low angular acceleration unlikely to result in harm, while a faster stop will cause greater acceleration more capable of causing injury. (7T27-25 to 29-16)

validate the shaking theory. Rather, these studies have repeatedly shown that "the angular accelerations that are created in shaking . . . are less than what we see" in events not associated with intracranial injuries, even when the studies replicated very small children or involved some impact. (Pa 418-19; 7T38-14 to 39-6, 41-10 to 49-4, 87-16 to 92-6) Thus, Dr. Van Ee opined that there is currently no "scientific basis" for finding that shaking can cause the triad. (7T46-20 to 47-5, 52-25 to 55-2, 62-3 to 15, 95-19 to 96-20)

Moreover, while research has failed to show that shaking can cause the triad, Dr. Van Ee testified without challenge that shaking can cause injury to a child's neck, which is comparatively weak and prone to injury. (7T32-7 to 34-14, 38-14 to 39-24) Thus, Dr. Van Ee testified that the theory that shaking is "likely to result in injurious angular acceleration/deceleration resulting in direct damage to bridging veins and diffuse axonal injury while simultaneously not injuring the neck or torso cannot be scientifically supported." (7T38-3 to 39-24) Dr. Van Ee also testified that the lack of biomechanical support cannot be made up for with confession studies because they are largely unverifiable and rely on unknown and uncontrollable variables. (7T97-9 to 100-5)

III. THE COURT'S RULING

On January 7, 2022, Judge Jimenez issued an order and written opinion excluding Dr. Medina's testimony regarding AHT. (Pa 2-78) Judge Jimenez

based this holding on his findings that shaking-only "AHT has never been medically nor scientifically validated" and that the State had failed to provide any evidence "that humans can produce the requisite physical force necessary to produce" the triad. (Pa 71) Thus, because "no study has ever validated the hypothesis that shaking a child can cause the triad[,]" Judge Jimenez concluded that shaking-only AHT is "based upon speculation and extrapolation instead of . . . reliable testing" and must be excluded. Ibid. At the same time, Judge Jimenez made clear that the State could introduce testimony regarding AHT when "it is coupled with physical evidence that an accused subject the infant-victim to some impact of physical trauma . . . ." (Pa 75)

LEGAL ARGUMENT

POINT I

THE MOTION COURT PROPERLY EXCLUDED EXPERT TESTIMONY ABOUT ABUSIVE HEAD TRAUMA BY SHAKING BECAUSE THE STATE FAILED TO CLEARLY PROVE THAT THE RELEVANT SCIENTIFIC COMMUNITIES GENERALLY ACCEPT AS RELIABLE THAT SHAKING CAN CAUSE INTRACRANIAL INJURIES WITHOUT OTHER INJURIES.

The main issue in this case is whether the motion court properly excluded expert testimony concerning the shaking-only theory of AHT. To establish admissibility, the State had to show that the testimony satisfied N.J.R.E. 702, including that it would "assist the trier of fact to understand the

evidence or to determine a fact in issue . . . .” In doing so, State had to prove that the shaking theory is “at a state of the art such that an expert’s testimony could be sufficiently reliable . . . .” State v. Kelly, 97 N.J. 178, 208 (1984).

In criminal cases, that question is assessed under the standard announced in Frye v. United States, 293 F. 1013 (D.C. Cir. 1923), with the State required to show that the theory is “sufficiently established to have gained general acceptance in the particular field in which it belongs.”[11] State v. Harvey, 151 N.J. 117, 169 (1997). The State must “clearly establish” such acceptance, id. at 170 (citation omitted), because “a high degree of reliability is necessary where the freedom, or even the life, of an individual is at stake.” Biunno, Weissbard & Zegas, Current N.J. Rules of Evidence, cmt. 3 on N.J.R.E. 702 (2022). Trial courts must act as “gatekeepers” ensuring this burden is met. State v. Sowell, 213 N.J. 89, 99-100 (2013) (citation omitted).

The court here adhered to this gatekeeping role, and the high reliability standards in New Jersey, when it excluded testimony that shaking a child can cause subdural hematomas, retinal hemorrhages, and neurological impairment without other injuries. (Pa 67-78) The court reached this conclusion because that theory “has never been medically nor scientifically validated as a

[11] In 2018, the Supreme Court adopted a different standard for civil cases. In re Accutane Litigation, 234 N.J. 340, 399 (2018).

diagnosis" and because the State failed to produce any tests or literature proving "that humans can produce the requisite physical force necessary to produce the symptoms in an infant associated with AHT" even after years of litigation. (Pa 71) In other words, the court found that the State failed to show that the shaking-only theory had successfully advanced from a hypothesis to a generally accepted and reliable principle fit for a criminal trial.

The court's credibility and factual findings underlying this conclusion are entitled to deference and should not be disturbed because "they are supported by substantial credible evidence in the record . . . ." State v. J.L.G., 234 N.J. 265, 301 (2018) (quoting State v. Chun, 194 N.J. 54, 93 (2008)). And while the question of "[w]hether expert testimony is sufficiently reliable" is reviewed de novo, ibid., the State is wrong that the record, or the additional information it cites, calls for overturning the motion court's well-reasoned decision. This Court should therefore reject the State's arguments and conclude that it failed to carry its burden of proof, just as the motion court did.

A. The State Was Required to Prove the Reliability of the Shaking-Only Theory, Not Abusive Head Trauma as a General Concept.

The State first argues that the court erred because there is no dispute "that the medical community generally accepts AHT as a valid diagnosis." (Pb 22-23) This argument, in addition to unduly limiting the relevant scientific community, as discussed in Point I.B., is misleading because it fails to

distinguish between AHT as a general concept, which is not in dispute, and AHT by shaking, which is at issue here. It should therefore be rejected.

The proponent bears the burden of proving that the specific "scientific theory" at issue is reliable. Harvey, 151 N.J. at 171; see J.L.G., 234 N.J. at 308 (holding that general acceptance of one component of theory did not render overall theory admissible). Stated differently, a proponent cannot establish general acceptance simply by showing that a broader theory or category of knowledge has been generally accepted. Rather, proof of acceptance specific to the theory at issue is required. See State v. Rochat, 470 N.J. Super. 392, 449-50 (App. Div.) (finding State failed to establish reliability of specific DNA software), certif. denied, ___ N.J. ___ (2022); State v. Boyington, 153 N.J. Super. 252, 254-55 (App. Div. 1977) (finding State failed to prove general acceptance of specific radar speed detection system).

The theory at issue here is whether an adult can shake a child with enough force to cause subdural hematomas, severe retinal hemorrhages, and neurological impairment, without causing other injuries. Despite the State's claims, this theory is not interchangeable with AHT as a general matter. Rather, AHT is an umbrella term that covers any "inflicted injury of the skull or intracranial contents in an infant or a child under five years." (4T26-18 to 25) AHT therefore covers many forms of injury, including crushing and blunt

head impact (4T31-17 to 32-14), and AHT by shaking cannot be validated simply because other forms of AHT, or AHT in general, are not in dispute.

That children can suffer head trauma from abuse is an uncontroversial fact, as the defense experts readily acknowledged. See (6T103-22 to 105-2 (Dr. Mack acknowledging general acceptance of AHT "[i]n the context [that] children can be abused, and abused around their head")); (7T86-19 to 87-15 (Dr. Van Ee acknowledging general acceptance of AHT in general)); (8T3-18 to 5-17 (Dr. Scheller acknowledging acceptance of "abusive head trauma" in general)). But whether children may experience head trauma from abuse in general has nothing to do with the entirely separate question of whether the type of abuse alleged here, shaking, can cause the triad, without other injuries. The State therefore could not, and did not meet its burden simply because the defense did not contest that abuse can cause head trauma.

B. The Relevant Scientific Communities for Which General Acceptance Is Required Include Both Biomechanics and Medicine.

The State further argues that the court erred because it considered biomechanical research. (Pb 48-49) Underlying the State's argument is its contention that the relevant scientific community does not include biomechanists, as the motion court found (Pa 69-75), and is instead limited to only medical providers who evaluate and treat children suspected of AHT and who "have obtained subspecialty certification, or are eligible for subspecialty

certification, in the field of child abuse." (Pb 48-49 (quoting Sandeep Narang, A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome, 11 Hous. J. Health L. & Pol'y 505, 581 (2011))). In other words, the State argues that the court erred because it should have only considered the opinions of child abuse pediatricians (CAPs) like Dr. Medina.

This argument is unpersuasive for two main reasons. First, and more generally, it overlooks that AHT is a multi-disciplinary diagnosis that incorporates and relies upon multiple scientific communities, rather than just CAPs. Second, and more specifically, it fails to acknowledge that biomechanics is one of the incorporated communities for the shaking-only theory of AHT because that theory was developed and grounded based on biomechanical research and principles, as the State's own expert conceded. Accordingly, this Court, like the motion court, should reject the State's efforts to so narrowly limit the relevant community to include only CAPs, and should instead consider biomechanics, as well as the broader medical field.

Defining the relevant scientific community is a critical aspect of the N.J.R.E. 702 analysis. Courts must not overly restrict the opinions they consider. Windmere, Inc. v. Int'l Ins. Co., 105 N.J. 373, 379-82 (1987). Courts must also avoid defining the community "so narrowly that the expert's opinion will inevitably be considered generally accepted[,]" Canavan's Case, 733

N.E.2d 1042, 1050 n.6 (Mass. 2000), or only consider the opinions of scientists who have a stake in the theory's acceptance. Windmere, 105 N.J. at 381; see also In re Jordan R., 205 Cal. App. 5th 111, 123 (2012) (cautioning against relying upon opinions of experts who have "a long association" with a theory or have "a vested career interest in its acceptance").

Essential to avoiding these pitfalls is recognizing that there "might be more than one scientific community to consider." State v. Pickett, 466 N.J. Super. 270, 302 (2021). This will occur if the theory or opinion relies upon or "integrates multiple scientific disciplines." Id. at 277. When an opinion relies on multiple scientific disciplines, the proponent must establish general acceptance within each discipline. Id. at 323-24. Such "cross-disciplinary validation" is essential to ensure that the theory is completely reliable, rather than just in part. Ibid. For example, that a computer program for analyzing DNA "may be generally accepted in the field of DNA forensics" will mean little without proof that it has also "gained general acceptance in the computer science community to which it also belongs." Ibid. Such is the case with AHT.

While CAPs often diagnose abuse, they do not do so in a vacuum. As discussed, AHT covers a wide range of injuries and symptoms and does not employ a "specific diagnostic criteria." (4T26-18 to 27-24, 31-17 to 32-14, 113-14 to 24, 155-12 to 156-23, 158-2 to 6) Instead, a doctor will flag a

concern for abuse when certain symptoms are present, including the triad, and will then engage in a process of elimination to determine if there are alternative explanations for the symptoms.[12] (4T28-12 to 25, 52-9 to 53-4, 156-24 to 161-12) In other words, the symptoms create a "probability" of abuse that will lead to a diagnosis absent alternative explanation. (5T54-12 to 55-12)

This process is known as a differential diagnosis. "As used in the medical community, a differential diagnosis is a medical construct for determining 'which one of two or more diseases or conditions a patient is suffering from, by systematically comparing and contrasting their symptoms." Creanga v. Jardal, 185 N.J. 345, 355 (2005) (quoting Dorland's Illustrated Medical Dictionary 377 (23d ed. 1957)). Its application depends first on "'rul[ing] in' all plausible causes for the patient's condition by compiling 'a comprehensive list of hypotheses that might explain'" the symptoms. Id. at 356 (quoting Clausen v. M/V New Carissa, 339 F.3d 1049, 1057 (9th Cir. 2003)). Once all plausible causes have been identified, the expert will "rule out those causes that did not produce the patient's condition" until only one cause -- the diagnosis -- remains. Ibid. (citation omitted).

[12] For example, it is undisputed that subdural hematomas have "many" other causes, including coagulation abnormalities, BESS, infections, meningitis, and non-abusive trauma, while retinal hemorrhages can be caused by events like aneurisms, strokes, vomiting, coughing, "[o]r anything that causes too much pressure" in the brain. (4T54-1 to 55-8, 113-25 to 115-21; 5T175-3 to 8)

In the case of AHT, this process "involves consultation with multiple subspecialties" to determine whether any other "pathology or medical issues . . . might be contributing to" the condition. (4T29-17 to 30-9) AHT diagnoses regularly require "[c]onsultants in radiology, ophthalmology, neurosurgery, and other subspecialties" to ensure an accurate diagnosis. Cindy W. Christian et al., Abusive Head Trauma in Infants and Children, 123 Pediatrics 1409, 1411 (2009). For example, Dr. Medina testified that she had consulted with geneticists, radiologists, and hematologists, among others, about the various other potential causes for D.J.'s symptoms. (4T83-14 to 87-7) Thus, as Dr. Medina testified, the AHT diagnosis is a "multi-disciplinary" process because it involves ruling in and ruling out explanations based on numerous scientific fields other than child abuse pediatrics. (4T72-10 to 73-23; 5T15-13 to 19); see also Arabinda Kumar Choudhary et al., Consensus Statement on Abusive Head Trauma in Infants and Young Children, 48 Pediatric Radiology 1048, 1049 (2018) (Pa 139 (noting diagnosis is made by a "multidisciplinary team")). Accordingly, AHT necessarily "integrates multiple scientific disciplines" such that general acceptance cannot be established based solely on the opinions of CAPs. Pickett, 466 N.J. Super. at 277, 302.

Indeed, a differential diagnosis is reliable only if the various explanations were ruled in and ruled out in a reliable way. "A differential

diagnosis that 'rules in a potential cause that is not so capable'" of causing the symptoms "has not been properly conducted." Creanga, 185 N.J. at 356 (quoting Clausen, 339 F.3d at 1058); see also Ruggiero v. Warner-Lambert Co., 424 F.3d 249, 254-55 (2d Cir. 2005) (finding diagnosis unreliable when expert "used a differential diagnosis to rule out competing causes . . . without establishing that [the claimed cause] is among them"); Bowers v. Norfolk S. Corp., 537 F. Supp. 2d 1343, 1361-62 (M.D. Ga. 2007) (citation omitted) (stating diagnosis is reliable only if proponent proves "potential cause can in fact cause the injury"); Hall v. Baxter Healthcare Corp., 947 F. Supp. 1387, 1413 (D. Or. 1996) (stating diagnosis is reliable only if "general causation has been proven for the list of possible causes"). A diagnosis is also unreliable if a hypothesis was excluded without "using scientific methods and procedures . . . ." Clausen, 339 F.3d at 1058 (quoting Claar v. Burlington N. R.R. Co., 29 F.3d 499, 502 (9th Cir. 1994)). A differential diagnosis, in other words, is only reliable if the proponent shows that causes were ruled in and ruled out based on generally accepted and reliable principles. Creanga, 185 N.J. at 357-58.

In sum, an AHT diagnosis can only be reliable if the underlying process of elimination was reliable. And because the AHT differential diagnosis entails a multidisciplinary process, it necessarily requires consideration of all fields that were employed. An AHT diagnosis that relied on ruling out a blood

disorder, for example, would involve hematology, while one that considered a metabolic disorder would involve geneticists. In each case, the CAP relies on principles beyond their own expertise, such that the reliability of the diagnosis can only be assured by establishing that each possible cause was ruled in or ruled out by applying reliable principles based on the field in which it belongs.

The relevant scientific community therefore cannot be limited to CAPs because CAPs can only render a diagnosis based on opinions from other scientific fields. Limiting the field to CAPs would therefore fail to ensure reliability, while also creating a clear risk of inevitable validation because CAPs are trained to accept shaking-only AHT and are primarily involved in rendering such diagnoses. (4T13-11 to 14-10, 29-8 to 30-15, 73-11 to 23, 132-14 to 18); Windmere, 105 N.J. at 381. The relevant community must therefore include all fields involved in a particular diagnosis to allow for the "possibility of disagreement[,]" Canavan's Case, 733 N.E.2d at 1050 n.6, and to ensure the its complete reliability. Creanga, 185 N.J. at 355-56 (citation omitted).

In the case of shaking-only AHT, this must include the field of biomechanics. "Biomechanics is the study of biological systems through mechanical principles," MIT, Biomechanics, https://be.mit.edu/research-areas/biomechanics, including to address "injury control" and prevention. Albert I. King, Impact Biomechanics, 34 The Bridge 11, 11 (2004),

https://www.nae.edu/File.aspx?id=7291&v=d4662b80. Stated differently, biomechanics, and impact biomechanics in particular, looks "at the human body as from a mechanical perspective" to better understand "the forces or accelerations that give rise to injury." (7T26-12 to 20)

As explained by Dr. Van Ee, it was biomechanists in the 1940s who first recognized that angular acceleration can cause intracranial injury. (7T27-2 to 12) The biomechanical understanding of angular acceleration has since advanced using computer models, cadavers, and live subjects, to that point that it now undergirds many areas of daily life, from the development of infant car seats, airbags, and seatbelts, to the designs of football helmets and military equipment. (7T7-2 to 16, 11-19 to 12-8, 29-4 to 31-4, 40-8 to 41-2, 103-6 to 10, 106-17 to 108-12, 110-15 to 121-6); see also Dennis R. Durbin et al., Child Passenger Safety, 142 Pediatrics 1, 5 (2018) (Da 84 (detailing guidance on car seat safety based on biomechanics)); Nat'l Football League, Using Biomechanical Research to Support Improvements in Helmet Technology (Oct. 5, 2017), https://www.nfl.com/playerhealthandsafety/equipment-and-innovation/engineering-technology/using-biomechanical-research-to-support-improvements-in-helmet-technology (discussing biomechanics in developing football helmets). Biomechanics has also been used to determine whether an event could account for observed injuries. (7T8-14 to 19, 26-20 to 27-1)

As Dr. Medina testified, it was the biomechanical understanding of angular acceleration that led to the development of the shaking theory. In 1971, Dr. A.N. Guthkelch published a paper exploring cases of children who experienced subdural hematomas without external signs of injury. A.N. Guthkelch, Infantile Subdural Haematoma and its Relationship to Whiplash Injuries, 2 British Med. J. 430, 430-31 (1971) (Da 1-2); (4T31-2 to 6) Dr. Guthkelch assumed that these symptoms were caused by abuse based on the existing theory that "all cases of infantile subdural haematoma are best assumed to be traumatic." (Da 2); see also C. Henry Kempe et al., The Battered-Child Syndrome, 181 J.A.M.A. 17, 17 (1962) (Da 3 (suggesting abuse "should be considered in any child" with subdural hematomas)). With that assumption in mind, Dr. Guthkelch sought to determine the abuse that could cause subdural hematomas without causing other observable injuries.

Ultimately, Dr. Guthkelch hypothesized that the hematomas were caused by shaking. In doing so, Dr. Guthkelch relied on a 1968 study by Dr. Ayub Ommaya (Da 1-2), in which fifty rhesus monkeys were subjected to whiplash in simulated car accidents without head impact. Ayub K. Ommaya et al., Whiplash Injury and Brain Damage, 204 J.A.M.A. 285, 285-86 (1968) (Pa 160-61). Following the accidents, which occurred at roughly thirty miles per

hour, nineteen of the monkeys were found to have been concussed and fifteen of those nineteen had subdural hematomas. (Pa 161-62; 5T122-19 to 21)

Although Dr. Ommaya's study involved simulated car crashes, Dr. Guthkelch cited it in his research for the principle that subdural hematomas can be caused by a "whiplash injury to the neck" without injury to the "head itself."[13] (Da 1) Based on this principle, Dr. Guthkelch postulated that shaking can cause the same amount of force as a simulated car accident, and hence can also cause subdural hematomas without external injuries. (Da 1-2) As Dr. Guthkelch explained, "[i]t seems clear that the relatively large head and puny neck muscles of the infant must render it particularly vulnerable to whiplash injury" and that in "some cases repeated acceleration/deceleration" from shaking can cause subdural hematomas without other injuries. Ibid.

Accordingly, Dr. Guthkelch derived the shaking-only theory from biomechanical research, and biomechanical principles have remained central to that theory ever since. See (Da 2 (Guthkelch explaining theory based on biomechanical "device" utilized by Ommaya)). Dr. John Caffey, for example, cited to the effects of "acceleration-deceleration" forces, as well as Dr. Ommaya's research, when he coined the term Shaken Baby Syndrome in 1974.

[13] Dr. Guthkelch also noted that subdural hematoma can occur after "slight head injuries" and discussed two cases in which children with subdural hematoma, one of which also had bruising, may have been subjected to shaking. (Da 1-2)

(4T31-11 to 16, 129-2 to 4); John Caffey, The Whiplash Shaken Infant Syndrome: Manual Shaking by the Extremities with Whiplash-Induced Intracranial and Intraocular Bleedings, Linked with Residual Permanent Brain Damage and Mental Retardation, 54 Pediatrics 396, 401-03 (1974) (Da 20-22) Proponents of the shaking theory have also sought validation for the shaking theory through numerous biomechanical studies, as discussed below in Point I.C.1., and uniformly continue to explain the theory in biomechanical terms. See, e.g., Choudhary, 48 Pediatric Radiology at 1051-1053 (Pa 143 (stating triad is caused by "acceleration/deceleration" forces)); Narang, 11 Hous. J. Health L. & Pol'y at 541, 548 (same); Catherine Adamsbaum et al., Abusive Head Trauma: Judicial Admissions Highlight Violent and Repetitive Shaking, 126 Pediatrics 546, 547 (2010) (Pa 278 ("Violent shaking is thought to subject the infant's head to acceleration-deceleration and rotational forces . . . which result[] in subdural, subarachnoid, and retinal hemorrhages . . . .")).

Dr. Medina similarly explained the shaking theory in terms of biomechanics, including by stating that it is based on the "concept of whiplash injury" and "acceleration and deceleration forces." (Pa 115; 4T34-12 to 18, 168-8 to 25; 5T53-15 to 54-7) Dr. Medina also testified that biomechanics is one of the fields that CAPs are trained in, relied on the Ommaya study when claiming that "shaking is worse" than a car accident in terms of "whiplash,"

and cited other biomechanical studies when she thought they supported her position. (4T36-11 to 18, 38-18 to 39-4, 124-9 to 25) The State also cited, and continues to cite, biomechanical research. (Pb 43, 49)

Thus, in the case of shaking-only AHT, the relevant scientific field must include biomechanics because the theory that shaking can cause the triad was developed based on biomechanical research and remains rooted in biomechanical principles. Shaking, in other words, has been "ruled into" the AHT differential diagnosis based on biomechanics, and thus its ability to cause the observed symptoms must be established in that field. Creanga, 185 N.J. at 356; see also Hall, 947 F. Supp. at 1413 (quoting Cavallo v. Star Enterprise, 892 F. Supp. 756, 771 (E.D. Va. 1995)) ("[T]he final, suspected 'cause' remaining after this process of elimination must actually be capable of causing the injury."). In sum, the shaking-only theory was premised on biomechanics and continues to be defined, tested, and explained in terms of biomechanics, such that biomechanics is one of the relevant fields in which the State had to establish reliability, as the motion court necessarily found. (Pa 71-74)

C. The State Failed to Clearly Prove that the Fields of Biomechanics and Medicine Generally Accept that Shaking Can Cause the Triad Without Causing Other Injuries.

Because the shaking theory of AHT lies at the intersection of biomechanics and medicine, the State was required to clearly establish

generally accepted reliability in both fields. General acceptance can be established by "expert testimony, authoritative scientific and legal writings, and judicial opinions." J.L.G., 234 N.J. at 281 (citation omitted). "Proof of general acceptance within a scientific community can be elusive" and "involves more than simply counting how many scientists accept the reliability of" the theory. Harvey, 151 N.J. at 171 (citations omitted). Although uniform acceptance is unnecessary, State v. Cassidy, 235 N.J. 482, 492 (2018) (citations omitted), the proponent must show that the theory is "widely" accepted as reliable. Harvey, 151 N.J. at 171.

The importance of reliability cannot be overstated. Indeed, "[g]eneral acceptance is not an end in itself" and is instead a tool "to ascertain whether a sufficient level of reliability has been achieved." State v. Doriguzzi, 334 N.J. Super. 540, 546 (App. Div. 2000). "It is reliability that must be assured" above all else, In re R.S., 173 N.J. 134, 136 (2002) (citation omitted), with the proponent required to prove that the theory rests on a "scientifically reliable" basis and methodology, Landrigan v. Celotex Corp., 127 N.J. 404, 417 (1992), and that it produces "uniform and reasonably reliable results." State v. J.R., 227 N.J. 393, 409 (2017) (quoting Kelly, 97 N.J. at 210). Establishing that level of reliability "entails the strict application of the scientific method, which requires an extraordinarily high level of proof based on prolonged, controlled,

consistent, and validated experience." Harvey, 151 N.J. at 171 (quoting Rubanick v. Witco Chem. Corp., 125 N.J. 421, 436 (1991)).

Science is rooted in the idea "that events occur in consistent patterns that can be understood through careful comparison and systematic study." Nat'l Research Council of the Nat'l Academies, Strengthening Forensic Science in the United States: A Path Forward 112 (2009), https://www.ojp.gov/pdffiles1/nij/grants/228091.pdf. The scientific method lays out "a series of steps" to identify those patterns. Ibid. Scientists must first collect data and then infer "causal relationships," or develop hypotheses, based on that data. Ibid. Once developed, hypotheses are tested, "measured against the data, and are either supported or refuted." Ibid. "Ultimately, the goal is to construct explanations ('theories') of phenomena that are consistent with broad scientific principles," which can then be challenged by other scientists, including through "experiments designed to test the theory under different conditions." Ibid. "Acceptance of the work comes as results and theories continue to hold, even under the scrutiny of peers, in an environment that encourages healthy skepticism." Ibid. Thus, reliability may only be established if the proponent clearly shows that the theory is widely accepted as reliable in all relevant communities based on repeated testing.

The motion court did not err in finding that the State failed to carry that heavy burden here. Despite being based in biomechanics, the State conceded that the shaking-only theory has never been validated in that field. (Pb 42) The State also failed to establish the medical reliability of the theory as it relied on unproven theories of causation and unreliable and inconsistent confession studies rather than peer-reviewed scientific testing. The State also could not compensate for its lack of scientific authority with case law, particularly given the mixed judicial treatment of the shaking-only theory, or its claimed errors specific to Judge Jimenez's reasoning. Affirmance is therefore required.

1. The State failed to prove that the shaking-only theory is generally accepted as reliable in the field of biomechanics.

The motion court found that the State failed to establish reliability because it could not point to any test or literature showing "that humans can produce the requisite physical force necessary to produce" the triad. (Pa 71) The State did not, and does not, dispute this conclusion as it relates to biomechanics. (Pb 42) Nor could it, as repeated biomechanical testing has failed to validate the theory that humans can shake a child with sufficient force to cause the triad without causing other injuries. The State therefore failed to meet its burden and the testimony was rightly excluded.

As noted, Dr. Guthkelch first postulated that shaking can cause subdural hematomas based on Dr. Ommaya's finding that such injuries could be caused

by whiplash in car accidents. (Da 1-2) Dr. Guthkelch did not, however, offer a basis for believing that shaking could cause the same force and injuries as a thirty mile-per-hour car crash or provide any scientific basis to believe this was possible. Nonetheless, this hypothesis formed the basis for the shaking-only theory and researchers have repeatedly tested it, in line with the scientific method, to establish its validity. No research, however, has provided such validation, as all the experts agreed, and has instead indicated that the triad can only be caused with impact, and that neck injuries would also occur if a child was shaken with enough force to cause the triad of symptoms.

One of the first studies "[t]o test the hypothesis" was conducted by Dr. Ann-Christine Duhaime in 1987. Ann-Christine Duhaime et al., The Shaken Baby Syndrome: A Clinical, Pathological, and Biomechanical Study, 66 J. Neurosurg. 409, 411 (1987) (Pa 194). Dr. Duhaime had football players "shake a test device that represented a one-month-old child" "to see if shaking alone could reach the thresholds established by the Ommaya study." (4T37-15 to 21; 7T88-14 to 17) The resulting accelerations, however, "were very low and below the level of where they thought injury would take place for a child" until the devices were also subjected to physical impact. (4T37-22 to 38-3; 7T88-14 to 89-25) Thus, Dr. Duhaime concluded that the triad likely requires "blunt

impact" (Da 197; 4T37-24 to 38-3, 121-25 to 123-16), and "that shaking alone does not produce the shaken baby syndrome." (Pa 192, 197)

These results were later "confirmed," as Dr. Medina testified, in tests involving more advanced models. (4T38-4 to 9) As explained by Dr. Medina, Dr. Michael T. Prange found in 2003 "that vigorous shaking produced forces similar to those involved in small falls," which would not cause "intracranial injury" (4T38-5 to 14), and that Dr. Duhaime reached the same results in 2010. (4T123-14 to 24) In other words, as Dr. Medina conceded, "according to Duhaime and Prange, you couldn't reach the minimum established threshold with shaking alone." (4T38-15 to 17); see also Michael T. Prange et al., Anthropomorphic Simulations of Falls, Shakes, and Inflicted Impacts in Infants, 99 J. Neurosurg. 143, 149 (2003) (Pa 205 (finding "no data showing that [force] of the head experienced during shaking . . . is sufficient to cause SDHs or primary [traumatic axonal injuries] in an infant")).

The same results were reached in the other studies cited by the State and Dr. Medina. For example, while Dr. Medina claimed that two studies showed that shaking could "surpass[] the injury thresholds produced by the original Ommaya study[,]" those studies involved impact between the model's head and body. (4T38-18 to 39-11; 7T90-23 to 91-24); Carole A. Jenny et al., Biomechanical Response of the Infant Head to Shaking: An Experimental

Investigation, 34 J. of Neurotrauma 1 (2017) (Pa 165-74); C.Z. Cory & M.D. Jones, Can Shaking Cause Fatal Brain Injury? A Biomechanical Assessment of the Duhaime Shaken Baby Syndrome Model, 318 Med. Sci. Law 317 (2003) (Pa 175-91). Moreover, and contrary to Dr. Medina's interpretation, those studies only found that shaking with impact could produce concussion, not intracranial injury. (7T91-25 to 92-4); see (Pa 172 (noting shaking with impact exceeded "injury threshold levels for concussion" but not "diffuse axonal injury")); (Pa 175 (stating shaking with impact got "closer to" but did not exceed "internal head injury, subdural haematoma" threshold)).

Dr. Van Ee, the only biomechanist to testify, also explained that no study has shown that shaking can cause subdural hematomas and retinal hemorrhages. (Pa 412-20; 7T52-25 to 54-13) Rather, Dr. Van Ee explained that past studies have shown that "the angular accelerations that are created in shaking . . . are less than what we see in even a one-foot fall" onto carpet, which is normally not associated "with a subdural hemorrhage or a massive traumatic head injury" and that similar results were found even with models replicating very young and small infants, and when shaking was combined with a slam onto a soft surface.[14] (Pa 418-19; 7T38-21 to 39-6, 41-10 to 49-4)

[14] The State's contrary claim that the triad can be caused by shaking with impact on a soft surface (Pb 49), is unsupported by the single biomechanical study it cites and is contradicted by the actual research addressing that issue, as Dr. Van

Dr. Van Ee also testified that the "levels of force" from the Ommaya study "are far beyond what a person can generate in shaking," as Dr. Ommaya himself later acknowledged. (7T34-25 to 37-14); see A.K. Ommaya et al., Biomechanics and Neuropathology of Adult and Paediatric Head Injury, 16 Brit. J. of Neurosurg. 220, 221 (2002) (Da 43 (explaining his whiplash study involved forces "not seen in even the most violent shaking")).

Dr. Van Ee also testified about his own research, including a study comparing the force found in shaking to other traumatic events, like falls, car accidents, and football injuries. (7T49-5 to 51-2) As Dr. Van Ee explained, the premise of this study was that if shaking causes injury due to acceleration, then the triad should also be present following events that create even greater acceleration. (7T51-3 to 9) This, however, turned out not to be the case, including in cases of car accidents without impact and one-foot falls onto linoleum. (7T51-9 to 17) Accordingly, this research, like other biomechanical findings, failed to show that shaking can cause the triad.[15] (7T54-14 to 55-2)

Ee testified. See Ann–Christine Duhaime & Cindy W. Christian, Abusive Head Trauma: Evidence, Obfuscation, and Informed Management, 24 J. Neurosurgery 481, 482 (2019) (Pa 576 (stating impact on soft surface can create significant deceleration without claiming it can produce triad); see also (Pa 205 (finding insufficient force for intracranial injury from shaking and impact against foam)).

[15] This testimony also demonstrated that there are quantifiable ranges of force in which injuries happen (7T106-4 to 16), contrary to Dr. Medina's claim that "no one really knows the injury thresholds" for head trauma. (4T39-5 to 40-12)

Thus, as is required under the scientific method, researchers have repeatedly tested Dr. Guthkelch's shaking hypothesis under different and varying conditions. These tests, however, have uniformly failed to establish that humans can shake children with sufficient force to cause the triad, such that general acceptance cannot be established. (7T92-13 to 20, 95-19 to 96-20) Indeed, even Dr. Medina recognized that there is "controversy" as to whether shaking "can cause the forces needed to generate intracranial injury in infants" (4T34-7 to 35-5, 129-5 to 24, 132-14 to 21), and the State has not argued otherwise. Exclusion was therefore required.

Moreover, while research has failed to validate the shaking theory, it is undisputed that it has shown that the necessary level of force would injure a child's neck, which is comparatively weak and prone to injury, before resulting in intracranial damage. (7T32-7 to 34-14, 39-7 to 24); see Ommaya, 16 Brit. J. of Neurosurg. at 222 (Da 44) (noting "[d]amage to the neck and the spinal cord . . . would also be expected" if shaking caused the triad); see also (4T128-7 to 129-6; 5T180-16 to 185-11 (discussing animals studies in which shaken lambs suffered spinal injuries but few retinal hemorrhages)); J.W. Finnie et al., Neuropathological Changes in a Lamb Model of Non-Accidental Head Injury (The Shaken Baby Syndrome), 19 J. of Clinical Neuroscience 1159 (2012) (Pa 379-84); 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. of Clinical Neuroscience 237 (2009) (Pa 375-78). Thus, while we may not "know if you can get [to the injury threshold] with shaking for the head," the research shows that "you can get there for the neck[,]" such that neck injuries would occur if shaking caused the triad. (7T38-14 to 39-24)

Accordingly, the biomechanical theory of shaking has been repeatedly tested but never validated. Instead, the research has shown that shaking cannot cause the triad without impact and that, even if enough force could be created, it would also result in injuries to the neck. The State does not dispute these conclusions, which were credited by the motion court, and instead simply tries to wave them away as irrelevant. The biomechanical basis for the shaking theory, and the basic tenets of reliability and the scientific method, however, cannot countenance such a result. Rather, because the shaking theory has never been biomechanically validated, and has instead been undermined, this Court should find that the State failed to clearly prove the theory's reliability.

2. The State failed to prove that the shaking-only theory is generally accepted as reliable in the field of medicine.

The State failed to establish admissibility based on its lack of reliable biomechanical evidence. The State also failed to carry its burden regarding the medical community. This is because the State did not clearly prove that there

exists a generally accepted and reliable medical basis to believe that shaking can cause the triad without causing other injuries, and instead relied on unsupported theories and unreliable and inconsistent accounts of confessed shaking. For that reason, affirmance is additionally required.

Dr. Medina testified that "shaking continues to be accepted as a mechanism" for subdural hematomas based on the premise that shaking can tear or rupture bridging veins -- large veins that bring blood from the brain to the heart. (4T41-2 to 7, 120-8 to 16, 169-1 to 15) Dr. Medina explained that the basis for this belief is "the assumption" that bridging veins can rupture just as they do for children with BESS. (4T169-10 to 15) Specifically, Dr. Medina testified that BESS "validates" that "tension can cause" bridging vein rupture "[i]n any other context[,]" including "[i]n a shaking situation," because "intracranial movement" can create "the same mechanism of stretching and tension" as is found in BESS. (4T48-12 to 19, 50-25 to 51-12, 120-20 to 121-24; 5T53-15 to 54-11) Dr. Medina did not, however, explain the basis for this assumption or why shaking could cause the same force or tension as found in BESS. Dr. Medina also did not explain why conditions found in children with BESS, an "anatomic variation" that can cause fluid buildup that puts children "at increased risk for subdural trauma," would apply to children without BESS. (4T45-3 to 10, 47-17 to 51-22, 121-2 to 24; 6T34-8 to 19) She also did not

opine on why the hematomas associated with BESS, which are generally benign, could be compared to the more severe hematomas associated with AHT. (4T48-21 to 52-22 to 54-23 to 55-4)

Accordingly, Dr. Medina did not provide a reliable basis to conclude that shaking can cause subdural hematomas. To the contrary, Dr. Medina conceded that "[n]o study shows" that shaking causes bridging veins to tear or that her theory had been validated. (4T169-5 to 25) Dr. Mack, moreover, testified that "there's no good evidence" to prove that "shaking can cause bridging vein rupture" (6T113-18 to 115-6), while further noting that bridging veins do not rupture easily due to their strength and elasticity, and that such a rupture would result in a significant loss of blood, constituting "a surgical emergency[,]" rather than a benign hematoma. (6T31-6 to 34-7)

Dr. Medina's second theory, concerning retinal hemorrhages, was similarly unsupported. Dr. Medina testified that "the vitreoretinal traction theory is what is felt to" explain how shaking can cause severe retinal hemorrhages. (5T62-14 to 20) Under this theory, shaking causes the vitreous, "a jelly-like substance within the eye[,]" to "pull against the retina causing rupture of the retinal vessels" that line the walls of the eye. (4T57-13 to 25, 67-22 to 68-6; 5T62-14 to 20, 178-20 to 179-13) Dr. Medina did not, however, identify any scientific evidence for this theory and conceded that there is no

test to determine the cause of retinal hemorrhage. (4T58-4 to 60-10) The other experts also undermined this theory, with Dr. Scheller testifying that it is anatomically impossible for the vitreous to obtain independent movement (5T179-14 to 180-5), and Dr. Mack testifying that the idea of different hemorrhage patterns is controversial. (6T122-2 to 123-5)

Accordingly, the State offered two theories to explain how shaking can cause the triad as a medical matter but failed to offer clear proof that either theory has been generally accepted as reliable. To the contrary, even the State's own proofs showed that these theories have not advanced from hypotheses to reliable principles upon which a criminal prosecution, and possible conviction, could be based. Indeed, the State does not seek to defend these theories on appeal and does not even mention them in its brief.

Instead, the State now asserts that it established general acceptance without articulating a theory as to how shaking can cause the triad without other injuries. For example, the State relies heavily on a consensus statement from the American Academy of Pediatrics and a law review article -- both involving the same author -- even they do not validate the shaking theory and even contradict some of Dr. Medina's testimony. (Pb 23-25; see Pa 146 (consensus statement disputing relevance of BESS to SDH)). General acceptance cannot be based on such tangential authority.

The State also could not establish general acceptance based upon the confession studies it cited before the motion court, or the additional studies it cites now. (See Pb 25-28) Most basically, not a single one of these studies explains how shaking can cause the triad without causing other injuries, including the neck injuries that biomechanics shows would be expected. Rather, they merely provide anecdotal evidence of correlation. The studies therefore cannot validate the shaking-only theory, as even some of the studies' authors acknowledged. See, e.g., Suzanne P. Starling et al., Analysis of Perpetrator Admissions to Inflicted Traumatic Brain Injury in Children, 158 Archives Pediatrics & Adolescent Med. 454, 454, 457 (2004) (Pa 341, 344 (noting "debate" as to shaking theory's reliability and that study merely "suggests that shaking alone is able to produce" triad)); Kenneth W. Feldman et al., Abusive Head Trauma Follows Witnessed Infant Shaking, Child Abuse Rev. e2739 (2022) (Pa 547 (noting "legal and medical debates" regarding shaking theory and noting study merely "provide[d] support").

The studies cited by the State also suffer from numerous limitations that leave even the issue of correlation in doubt. Most fundamentally, confessions and witnessed accounts carry inherent risks of unreliability particularly when, as in the studies cited by the State, the statements were made in high-stress situations involving an injured or deceased child, after abuse was already

presumed and the individual became a suspect. (4T68-23 to 72-9, 116-25 to 118-4; 5T132-17 to 133-13) Confessions and witnessed accounts, in other words, are not reliable scientific evidence, as many of the studies' authors acknowledged. See Matthieu Vinchon et al., Confessed Abuse Versus Witnessed Accidents in Infants: Comparison of Clinical, Radiological, and Ophthalmological Data in Corroborated Cases, 26 Child's Nervous Sys. 637, 639 (2010) (Pa 292 (noting confessions "may be unreliable" including because people "may seek to underestimate the violence of abuse")); (Pa 547 (Feldman noting "[w]itness statements might be inaccurate or modified by self-interest" and other issues)); (Pa 283-84 (Adamsbaum noting confessions "are not scientific evidence," are of questionable reliability, and may "be incomplete or minimized")); (Pa 343-344 (Starling noting confessions "may be inaccurate or incomplete, either purposefully or inadvertently," "may contain only partial descriptions of the events," and may not be "reliable scientific evidence")).

The studies also suffer from confirmation bias or circular reasoning since the authors sought to confirm the validity of an AHT diagnosis with a confession given based on that same diagnosis. (5T133-23 to 134-4); Göran Elinder et al., Traumatic Shaking: The Role of the Triad in Medical Investigations of Suspected Traumatic Shaking 19, 29-30 (2016) (Pa 225, 235-36). The studies therefore created a potential feedback loop, in which the

diagnosis effectively confirmed itself, without other causes being adequately considered (5T135-16 to 137-5; 6T60-7 to 61-1), as at least one study recognized. (Pa 292 (Vinchon noting risk of "bias" and "circularity")). The studies thus lack reliability because they rely on non-scientific information given by vulnerable people based on the same diagnosis they ostensibly prove.

Adding to their unreliability is the minimal information provided in the studies about the confessions and witnessed statements, and the circumstances in which they were made. (7T97-6 to 100-5); see (Pa 292 (Vinchon noting "limited data regarding" confessions and not describing them)); (Pa 282 (Adamsbaum providing only limited excerpts)); (Pa 342-344 (Starling noting confessions were not "detailed" and not describing them)); (Pa 542-43, 546 (Feldman providing limited detail of accusations)); Kent P. Hymel et al., An Analysis of Physicians' Diagnostic Reasoning Regarding Pediatric Abusive Head Trauma, 129 Child Abuse & Neglect 105666 (2022) (Pa 567-73 (not detailing nature of allegations)).[16] This lack of detail makes it impossible to assess the limitations of the studies both in terms of the reliability of the

[16] These issues also affected the review of confessions cited by the State, George A. Edwards et al., What Do Confessions Reveal About Abusive Head Trauma? A Systematic Review, 29 Child Abuse Rev. 253, 263-64 (2020) (Pa 560-61), including that it generally lacked "details beyond the mechanism of the injury." That study also did not limit itself to cases involving the triad or shaking-only cases, and did not seek to validate the shaking theory. (Pa 557-60)

statements -- such as by knowing when it was made, what the person was told, and whether they initially denied abuse -- and even assessing the mechanism or level of force allegedly used. (7T78-19 to 81-13, 97-6 to 100-5) In a similar vein, the lack of detail makes the studies' reliability depend on the subjective interpretations of the authors, the treating physicians, and law enforcement, and the assumption that they accurately characterized the statements.

This risk, as well as the harm stemming from confirmation bias, is illustrated by State v. Jacoby, No. 15-11-0917-I (Law Div. Aug. 17, 2018). (Da 23-41) Jacoby was arrested after his two-month-old son, P.J., was diagnosed with the triad and shaking-only AHT. (Da 24-27) Under police questioning, Jacoby said he "felt the weight of P.J.'s head lift off the crook of his arm and then come back against the crook of his arm" "a couple of times" while rocking him to sleep. (Da 24) The treating CAP did not believe that this conduct "would have been sufficient to cause P.J.'s medical findings." (Da 27) Nonetheless, both the CAP and the police classified Jacoby's statement as a "confession," as did the State in its prosecution. (Da 27-28, 38) The trial court, however, acting as the trier of fact, rejected this claim as "at the very least, a mischaracterization" and found that it undermined the validity of the diagnosis since it "prematurely" led the doctors to conclude that Jacoby caused P.J.'s injuries, without considering other explanations. (Da 37-38)

While only a single case, Jacoby shows the risk that police and doctors who have presumed abuse based on the triad will be predisposed toward over-categorizing statements as inculpatory. Indeed, it appears that similarly vague, or even innocuous, statements may have been treated as confessions to violent shaking in studies cited by the State. See (Pa 282 (Adamsbaum classifying statement that individual "shook" child "by her shoulders" as confessed violent shaking without additional details)). The use of detailed confessions, and the provision of those details, is therefore a baseline necessity for assessing the reliability of confession cases that is absent from the cited studies.

The studies' use of confessions is thus questionable because of the nature of confessions, the risk of circularity and bias, and the lack of information provided. Additionally, the studies also suffer from numerous other issues, including small sample sizes and inconsistent methodologies. The Vinchon study, for example, discounted the value of "clinical manifestations of encephalopathy" (Pa 293), despite that being one of the traditional triad symptoms identified by Dr. Medina. Moreover, that study only compared the group of "confessed" shaking cases with cases of accidental trauma, and not to situations where the symptoms arose from non-traumatic causes. (Pa 293-94)

The studies also failed to exclude cases involving evidence of impact or other injuries, likely inflating the rate of observed injuries from "shaking-

only" cases. See (Pa 280, 283 (noting Adamsbaum looked at twenty-nine cases of shaking but that eleven had fractures, three had skull fractures, eleven had bruising, one never had skeletal examination, and five had head impact)); (Pa 289, 293 (noting Vinchon study of forty-five shaking cases involved fifteen cases with impact and that "a minority" had scalp swelling and/or skull fractures without specifying number or symptoms)); (Pa 343-44 (noting four of thirty-two Starling shaking cases had "evidence of impact" without specifying their symptoms)); (Pa 544-45 (Feldman noting two of five cases had bruising and rib fractures, while another had facial skin injury)); (Pa 571 (Kent noting study of fifty-eight cases involved thirty-six cases with contact injuries)). This lack of precision casts additional doubt on the value of the study results.

Finally, the results are also too inconsistent for any firm conclusion to be drawn, even if taken at face value. The studies cited by the State, for example, ranged from finding some of the triad symptoms rarely to almost always, and often without accounting for their severity or whether they were all present. See (Pa 280 (Adamsbaum considering only cases with SDH and finding RH of any severity in 82.7 percent of cases and neurological symptoms in ninety-six percent)); (Pa 289-93 (Vinchon finding SDH in 82.2 percent of cases and severe RH in only 56.8 percent while noting "clinical manifestations of encephalopathy were often minimal")); (Pa 343 (Starling finding SDH in

ninety-one percent of cases and RH of any severity in eighty-four percent without indicating percent with both injuries or neurological symptoms)); (Pa 544-45, 47 (Feldman finding triad in only five of twenty-three cases,[17] or 21.7 percent)); (Pa 570 (Kent finding SDH in ninety-five percent of cases and severe RH in only sixty-three percent of cases)).

The picture is further muddied by research not cited by the State. A 2020 study, for example, found "no findings of SDH or RH" in thirty cases of confessed, witnessed, or recorded shaking, while finding such symptoms in a case of shaking with impact. Ingemar Thiblin et al., Medical Findings and Symptoms in Infants Exposed to Witnessed or Admitted Abusive Shaking: A Nationwide Registry Study, 15 PLOS ONE e0240182 (2020) (Da 65, 67-74). Likewise, and as Drs. Medina, Scheller, and Van Ee testified, there has yet to be a recorded instance of shaking resulting in the triad, despite numerous instances of shaking being captured on video.[18] (4T118-9 to 119-9; 5T131-13

[17] Contrary to the State's suggestion that the study only involved ten cases (Pb 38), it actually looked at twenty-three cases in total. (Pa 542, 546-47)

[18] The State's suggestion that such recordings do not exist (Pb 46), is belied by the hearing testimony, the cited studies, and its concession that Dr. Scheller provided a video. (Pb 46 n.10) Reports of recorded shaking in which the child was apparently uninjured are also readily available online. See, e.g., WMBF News, Father: Nanny Is a "Predator" (Apr. 22, 2009) (recorded shaking did not result in "signs of abuse"), https://www.wmbfnews.com/story/10150553/father-nanny-is-a-predator/; KABC, Fontana Nanny Cam Arrest Turns Focus on Signs of Child Abuse (Oct. 15, 2014) (recorded shaking described as only resulting in

to 132-8; 7T55-3 to 11, 121-17 to 122-4) The lack of triad symptoms in other cases of documented shaking further demonstrates the lack of reliable data showing that shaking can cause the triad without also causing other injuries.

Accordingly, the State failed to clearly prove the general acceptance of the shaking theory as a medical matter in multiple ways. Dr. Medina testified that shaking is medically capable of causing the triad based on theories that have not been proven and which the State has abandoned on appeal. The confessed and witnessed shaking studies that the State does rely upon on appeal, moreover, cannot establish reliability because they do not address the medical feasibility of the shaking theory and rely on unreliable information, detail that information in an untestable manner, involve inconsistent results, and are undermined by reports of recorded shaking.

General acceptance, simply put, cannot be based on a few small studies that fail to make clear what was said, the symptoms that were experienced, or whether impact was involved. It also cannot be based on studies which cannot even agree on a diagnostic framework, let alone on whether the triad is almost always associated with abuse (Pa 293), despite that being inconsistent with the differential diagnosis process, is associated with "only the most violent

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behavioral changes), https://abc7.com/nanny-arrested-for-beating-twins-fontana-ie-dana-cash/351076/.

shaking events" (Pa 547), or is likely unrelated to shaking. (Da 72-73) Moreover, and even more fundamentally, these studies cannot establish reliability when they are contradicted by established biomechanical research and do not address key issues involving the shaking theory, including whether shaking can cause the triad without causing neck injuries. Accordingly, this research does not clearly establish that the shaking-only theory is medically reliable, such that affirmance is further required.

3. The State failed to prove that the shaking-only theory is generally accepted based on judicial authority.

The State further argues that it established general acceptance through judicial authority. (Pb 29-31) This argument should be rejected because our State's jurisprudence does not favor admission; because general acceptance cannot be established based solely on out-of-state authority; because the cited authority does not even claim to find general acceptance in the field of biomechanics; and because the State misapprehends the state of judicial authority. Affirmance of the motion court's ruling is therefore required.

At the outset, admissibility cannot be established from the limited AHT-related case law in New Jersey because those opinions did not address the reliability of shaking-only AHT, were decided on an incomplete record, or found the testimony unreliable. For example, while the Supreme Court has mentioned the diagnosis, it has never implicitly or explicitly recognized its

reliability, contrary to the State's suggestions. See, e.g., State v. Galloway, 133 N.J. 631, 638 (1993) (noting diagnosis without addressing reliability). And while this Court has previously addressed the shaking theory, it only did so on a plain-error challenge that did not involve an evidentiary hearing or any defense experts, and based on research that is now over twenty-five years old. State v. Compton, 304 N.J. Super. 477, 483-87 (App. Div. 1997). That opinion thus carries little weight and should be discarded since it was decided based on limited information and before the shaking theory came under increased scrutiny. See J.L.G., 234 N.J. at 271-72 (reevaluating and excluding expert testimony deemed reliable twenty-five years earlier); State v. Moore, 188 N.J. 182, 207-08 (2006) (amending twenty-five-year-old rules on hypnotically refreshed testimony because "the scientific evidence . . . counsels another course"); see also Brundage v. Estate of Carambio, 195 N.J. 575, 593 (2008) (explaining "decision of one appellate panel" is not "binding upon another").

Indeed, this Court already indicated the need for revisiting the shaking theory when it remanded this case for a Frye hearing (Pa 79), and other courts have declined to follow Compton in recent years, just as the motion judge did here. Most notably, the Honorable Sohail Mohammed, J.S.C., addressed the admissibility of the shaking-only theory after conducting a Frye hearing in Jacoby, and, like Judge Jimenez, rejected its reliability. (Da 23-36) In doing

so, Judge Mohammad clarified that the validity of shaking-only AHT is distinct from AHT in general, noted the increased scrutiny that diagnosis has received, and found that it was inadmissible due to the lack of "reliable evidence" validating the vitreoretinal traction theory and the theory "that shaking alone causes subdural hematomas and retinal hemorrhages." (Da 29-31, 33-35) While non-precedential, this opinion shows that the shaking theory is on less secure judicial ground than the State suggests, especially since it has been rejected by the only two courts to conduct a Frye hearing in New Jersey.

The State is also wrong that it can establish the reliability of shaking-only AHT through out-of-state authority. Admissibility generally cannot be established "exclusively on judicial notice[,]" such that the State cannot use judicial opinions to compensate for its lack of persuasive scientific authority, particularly when there has already been an exhaustive evidentiary hearing in this case. Doriguzzi, 334 N.J. Super. at 539. Rather, the State's failure on those points, as discussed in Point I.C.1 and 2, should resolve the matter without consideration of outside judicial authority. See J.L.G., 234 N.J. at 288 (finding Child Sexual Abuse and Accommodation Syndrome unreliable despite being accepted in forty states and District of Columbia).

Additionally, the State cannot carry its burden because none of its cited cases even claim to have found general acceptance in the field of

biomechanics. As discussed in point I.B, biomechanists are one of the relevant scientific communities for shaking-only AHT and the State was required to establish general acceptance in that field. Because the State does not cite any judicial opinions addressing that field, and has failed to otherwise demonstrate such acceptance, it has not proven reliability and affirmance is required.

Finally, affirmance is required even if outside authority is considered because that authority is unpersuasive on its merits. "Reliance upon other courts' opinions can be problematic[,]" Doriguzzi, 334 N.J. Super. at 545 (quoting People v. Kirk, 681 N.E.2d 1073, 1078 (Ill. App. Ct. 1997)), as it runs the risk of adopting other court's views without sufficient "scrutiny, creating an authority 'house of cards.'" Pickett, 466 N.J. Super. at 316. For that reason, reliability cannot turn on "how many cases go in a certain direction[,]" Doriguzzi, 334 N.J. Super. at 546, or the mere "repetition of authority . . . ." Pickett, 466 N.J. Super. at 316. Rather, our courts will only credit out-of-state opinions where "the question of general acceptance has been thoroughly and thoughtfully litigated in the previous cases" and to the standards required in New Jersey. Doriguzzi, 334 N.J. Super. at 545 (quoting Kirk, 681 N.E.2d at 1078). The authorities cited by the State do not live up to this requirement.

Initially, many of the cases cited by the State did not even rule on the reliability of shaking-only AHT and are thus irrelevant.[19] See State v. Torres, 121 P.3d 429, 437-38 (Kan. 2005) (merely addressing sufficiency of the evidence); United States v. Vallo, 238 F.3d 1242, 1247 (10th Cir. 2001) (same); State v. Glenn, 900 So. 2d 26, 33-35 (La. Ct. App. 2005) (same); People v. Dunaway, 88 P.3d 619, 633 (Colo. 2004) (holding expert could testify subdural hematomas are caused by "massive and violent force"); People v. Martinez, 74 P.3d 316, 323 (Colo. 2003) (merely "assum[ing]" reliability of SBS); State v. Hatfield, 60 Kan. App. 2d 11, 17-22 (2021) (rejecting challenge to differential diagnosis and unrelated aspects of AHT).

The out-of-jurisdiction cases that did address the issue, moreover, all suffer from some combination of being decided based on out-of-date information, without a hearing, solely based on state evidence, on inapplicable standards, or without addressing causation. See State v. McClary, 541 A.2d 96, 101-03 (Conn. 1988) (ruling without evidentiary hearing or defense experts); State v. Leibhart, 662 N.W.2d 618, 626-28 (Neb. 2003) (finding court did not abuse discretion based on different test for admissibility and without defense experts); State v. West, 551 S.W.3d 506, 516-17 (Mo. Ct. App. 2018) (ruling

[19] The State also cites what appear to be several unpublished opinions from other jurisdictions without explanation or appending them to its brief. (Pb 30-31)

under plain-error standard, without a hearing, and based on testimony of only state experts); In re Pers. Restraint of Morris, 355 P.3d 355, 359-60 (Wash. Ct. App. 2015) (ruling without hearing and based on testimony of only state experts); Sissoko v. State, 182 A.3d 875, 895, 901-06 (Md. Ct. Spec. App. 2018) (finding court did not abuse discretion and without addressing causation); Wolfe v. State, 509 S.W.3d 325, 340-41 (Tex. Crim. App. 2017) (same); State v. Stewart, 923 N.W.2d 668, 675-76 (Minn. Ct. App. 2019) (same and without hearing); People v. Flores-Estrada, 55 Misc. 3d 1015, 1016-18 (N.Y. Sup. Ct. 2017) (ruling without hearing); People v. Ackley, 970 N.W.2d 917, 921 (Mich. Ct. App. 2021) (same); State v. Allen, 489 P.3d 555, 562-65 (Or. Ct. App. 2021) (ruling where defendant did not present experts or squarely raise issue below and under standard where causation did not need to be established), vacated on other grounds, 512 P.3d 446 (Or. 2022). Thus, the cases cited by the State carry little persuasive value because they do not address the specific issues in this case or approach the question of general acceptance with the same level of rigor required in New Jersey. Simply put, little can be gleaned from decisions made on a limited record, that do not address causation, or which applied a deferential standard of review, when this Court has a full record, the motion court excluded the testimony, and the State was required to meet a heightened standard of scientific reliability.

Moreover, any weight afforded to these cases is undermined by the numerous other courts that have questioned the validity of the shaking theory. See Commonwealth v. Millien, 50 N.E.3d 808, 820-21 (Mass. 2016) (noting "numerous scientific studies support[] the view that shaking alone cannot produce" triad); People v. Bailey, 999 N.Y.S.2d 713, 718 (N.Y. Cty. Ct. 2014) (crediting testimony that "shaking a child hard enough to cause brain injury also would cause neck injury"), aff'd, 41 N.Y.S.3d 625 (N.Y. App. Div. 2016); State v. Edmunds, 746 N.W.2d 590, 596 (Wis. Ct. App. 2008) (finding "a significant and legitimate debate in the medical community has developed in the past ten years" over SBS); Prete v. Thompson, 10 F. Supp. 3d 907, 957 n.10 (N.D. Ill. 2014) (suggesting "that a claim of shaken baby syndrome is more an article of faith than a proposition of science"); see also Cavazos v. Smith, 565 U.S. 1, 13 (2011) (Ginsburg, J., dissenting) (quoting Edmunds, 746 N.W.2d at 596) ("Doubt has increased in the medical community 'over whether infants can be fatally injured through shaking alone.'").

Thus, the State did not clearly establish general acceptance based on judicial opinions because our courts have more recently excluded shaking-only testimony and because the out-of-state authority, in addition to having limited value as a general matter, is silent on the issue of biomechanics and ultimately consists of a mix of irrelevant, distinguishable, and even unfavorable

decisions. The judicial authority thus provides little guidance other than further demonstrating that there is an active debate about the shaking-only hypothesis, such that the State failed to meet its burden.

4. The State's additional claims of error concerning the court's opinion are immaterial to the issue of general acceptance.

Lastly, the State argues that reversal is required because of various purported errors committed by the motion court. (Pb 31) These claims are largely irrelevant given this Court's de novo review of the court's legal findings, J.L.G., 234 N.J. at 301, and the principle that "an appeal is taken from a trial court's ruling rather than reasons for the ruling . . . ." State v. Adubato, 420 N.J. Super. 167, 176 (App. Div. 2011). They are also either inaccurate or immaterial as a substantive matter.

For example, Judge Jimenez did not "suggest[] that a diagnosis made through a process of elimination is not reliable" or that shaking-only AHT is unreliable because it lacks a "gold standard" diagnostic test. (Pb 31-34, 39-40) Rather, the judge excluded the testimony because there is no "reliable testing" showing that humans can create sufficient force to cause the triad without other injuries. (Pa 71) The court, in other words, found that the State failed to prove that the shaking theory is sufficiently reliable to be included in the diagnostic process, not that the diagnostic process itself is flawed, as it further clarified when it denied the State's motion for reconsideration. (10T5-4 to 15)

Judge Jimenez also did not apply "an incorrect legal standard." (Pb 34) While the judge briefly mentioned the reasonable doubt standard, he only did so while discussing the overall unreliability of the diagnosis. (Pa 76) The judge also did not exclude the testimony based on the inherently prejudicial nature of an AHT diagnosis and instead he only discussed the risk of prejudice to explain why ensuring the reliability of expert testimony is so important. (Pb 49-51; Pa 74-75; 10T10-1 to 13-2) Indeed, the court immediately followed its comments about prejudice by noting that testimony about AHT can be admitted when "coupled with physical evidence that an accused subjected the infant-victim to some impact of physical trauma." (Pa 75) For the same reason, the court also did not suggest that it was excluding testimony regarding any form of AHT other than AHT by shaking, which, of course, was the subject of the Frye hearing and the proposed testimony at issue here. (Pb 16)

Finally, Judge Jimenez did not disregard "compelling evidence" favoring the State. (Pb 35-47) The court discussed the confession studies, but was not required to credit them, especially given their significant shortcomings, as discussed in Point I.C.2. (Pa 14, 19) It also did not give undue weight to the cases of recorded shaking, particularly since the court specifically noted their limitations and did not cite them in its legal findings. (Pa 65) The court did not overlook that AHT diagnoses involve physical evaluations (Pb 44), and instead

explicitly noted as much. (Pa 70) Lastly, the court did not give improper weight to Dr. Scheller's cross-examination or err in assessing his credibility (Pb 47-48), particularly given the deference afforded to such findings, J.L.G., 234 N.J. at 301, the exaggerated nature of the State's claims,[20] and the fact that the court excluded the testimony based on the lack of evidence validating shaking-only AHT, with emphasis placed on Dr. Medina's testimony, rather than what Dr. Scheller said. (Pa 71-74) The State's claimed errors therefore do not alter the analysis or the fact that it failed to carry its burden of proof.

5. Conclusion.

To establish the admissibility of Dr. Medina's testimony, the State was required to clearly prove that the shaking-only hypothesis has advanced to a generally accepted and reliable principle in the fields of biomechanics and medicine. The motion court properly served its gatekeeping responsibilities when it found that the State did not meet this heavy burden based on the lack of reliable evidence showing that shaking can cause the triad and that it can do so without causing other injuries. Affirmance is therefore required.

[20] For example, the State characterizes Dr. Scheller's testimony that he had not practiced pediatrics for years when he had recently served as a summer camp doctor as proof that he "lied in prior testimony" (Pb 47; 5T101-2 to 102-15)

POINT II

THE MOTION COURT DID NOT CLEARLY ABUSE ITS DISCRETION WHEN IT DISMISSED THE INDICTMENT FOLLOWING THE EXCLUSION OF DR. MEDINA'S TESTIMONY.

The State argues that Judge Jimenez abused his discretion when he dismissed the indictment because it possessed "sufficient evidence" of Nieves's guilt "even without the testimony on the diagnosis of AHT." (Pb 55) Specifically, the State argues that it could have Dr. Medina testify that she ruled out various causes for D.J.'s injuries and that "based on her own experience as a practicing physician in the field of child abuse that inflicted trauma can cause injuries like the ones suffered by D.J." (Pb 56) This argument is wholly lacking in merit and must be disregarded.

Dismissal of an indictment is warranted when, "viewing the evidence and the rational inferences drawn from that evidence in the light most favorable to the State," "a grand jury could [not] reasonably believe that the defendant committed" the offense. State v. Morrison, 188 N.J. 2, 13 (2006). "[T]he decision whether to dismiss an indictment lies within the discretion of the trial court" and "ordinarily will not be disturbed on appeal" absent a clear abuse of discretion. State v. Hogan, 144 N.J. 216, 229 (1996) (citations omitted). Such a clear abuse of discretion did not occur here.

Dismissal was eminently appropriate because the State's case rested on the claim that D.J.'s injuries were caused by AHT from "a shaking event with or without impact[.]" (11T19-20 to 20-1) This claim evaporated once the State failed to establish the reliability of shaking-only AHT and Dr. Medina testified that D.J. did not have impact injuries. (5T9-21 to 10-9) At that point, the State could not prove causation -- that D.J. would not have been injured "but for" Nieves's conduct, Model Jury Charges (Criminal), "Causation (N.J.S.A. 2C:2-3)" (June 10, 2013) -- and lacked "evidence establishing each element of the crime" such that dismissal was required. Morrison, 188 N.J. at 12.

The State's claims to the contrary do not change that. For example, Dr. Medina would not be able to testify "that inflicted trauma can cause injuries like the ones suffered by D.J" (Pb 56), because that testimony is exactly what was excluded by the court. The State cannot sidestep the court's ruling by telling the jury the same information in a different, less specific way.

The State also could not carry its burden by having the jurors presume that Nieves caused the injuries simply because Dr. Medina could not identify a cause. While "a jury may draw an inference from a fact whenever it is more probable than not that the inference is true[,]" State v. Brown, 80 N.J. 587, 592 (1979), "[s]peculation . . . cannot be disguised as a rational inference." State v. Lodzinksi, 249 N.J. 116, 144-45 (2021). The State's argument that the jury

could presume that Nieves caused the injuries in some unexplained way is thus without merit because, as the motion court found, it relies on "getting the jury to speculate" about causation, rather than actual evidence. (Pa 87; 10T14-5 to 15-14) Accordingly, the court did not clearly abuse its discretion when it dismissed the indictment and affirmance is required.

CONCLUSION

For the reasons stated above, this Court should affirm the motion court's rulings excluding testimony regarding Shaken Baby Syndrome or Abusive Head Trauma by shaking and dismissing the indictment for lack of evidence.

Respectfully submitted,

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