STATE OF NEW JERSEY, Plaintiff/Appellant v. DARRYL NIEVES, Defendant/Respondent	SUPERIOR COURT OF NEW JERSEY APPELLATE DIVISION DOCKET NO.: A-002069-21T4 CRIMINAL ACTION ON APPEAL FROM A FINAL ORDER OF SUPERIOR COURT OF NEW JERSEY, LAW DIVISION, CRIMINAL PART COUNTY OF MIDDLESEX INDICTMENT NO. 17-06-00785-I SAT BELOW: HON. PEDRO J. JIMENEZ, JR., J.S.C.

PROPOSED BRIEF ON BEHALF OF MEDICAL PHYSICIANS IN SUPPORT OF THEIR MOTION FOR LEAVE TO APPEAR AS AMICI CURIAE

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Proposed Amici Curiae respectfully submit this Brief in support of their motion for leave to appear as Amici Curiae. Our proposed Brief accompanies this motion.

Statement of Interest of the Proposed Amici Curiae

Proposed Amici Curiae are medical physicians from various areas of expertise, including neurology, pediatrics, neuropathology, healthcare ethics, ophthalmology, surgery, neurosurgery, and neuroradiology. A full list of Amici is contained in Appendix A. Amici have reviewed cases and/or literature, and/or conducted research, and/or testified and/or lectured on the evidence base for purported diagnoses of "Shaken Baby Syndrome" (SBS) and "Abusive Head Trauma" (AHT). Amici believe that the Court's consideration of this case will be enhanced by a fuller understanding of the lack of evidence validating – and the existence of evidence affirmatively undermining – the theory that a constellation of findings known as the triad is diagnostic of abusive shaking, why and how the "SBS Hypothesis"[1] nevertheless became widely accepted as true, and the

[1] "Shaken Baby Syndrome"/SBS is a purported diagnosis that an infant has been abusively shaken. "Abusive Head Trauma"/AHT is a purported diagnosis that an infant has been the victim of abuse, generally in the form of *either* (a) shaking alone, (b) shaking plus blunt impact to the head, *or* (c) blunt impact to the head. The latter terminology was adopted in 2001 in response to growing evidence that shaking alone could not explain the triad constellation of findings. However, because that terminology refers to two different possible mechanisms of injury (shaking and blunt force impact), it is imprecise and obfuscates discussions and research regarding both types of mechanisms. For precision, and because only a theory of shaking without blunt impact to the head has been advanced in this case, this brief refers to the hypothesis that the triad is

current lack of general acceptance of the SBS hypothesis within the relevant scientific community.

Preliminary Statement

Though long accepted by the medical community and courts, alike, it is now clear that purported diagnoses of SBS and AHT based on the constellation of three findings commonly referred to as the "triad" are not based on reliable science and never were. In the 1990s and early 2000s, it was believed that when an infant presents with the triad of three medical findings - (i) subdural hematoma, (ii) retinal hemorrhages, and (iii) cerebral edema or encephalopathy - it can be inferred that the infant was the victim of abusive shaking by the person who had physical custody of the infant at the time the symptoms arose.[2] However, a review of the previous and recent research and data reveals that there is no scientific basis for such a conclusion and no reliable scientific studies validating the hypothesis that shaking can cause the triad. Furthermore, each element of the triad has numerous non-abusive causes that must be, but frequently are not, ruled out before abusive trauma can be considered as a possible explanation for an infant's injuries. At bottom, "Shaken Baby Syndrome" is not a

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diagnostic of abusive shaking as the "SBS hypothesis" rather than the "SBS/AHT hypothesis."

[2] A subdural hematoma is a type of intracranial hemorrhage or bleeding in area just under the dura, which is one of the protective layers of tissue that surrounds the brain. Retinal hemorrhages involve bleeding within the blood vessels of the retina. Cerebral edema is the swelling of the brain.

true medical diagnosis, much less a valid or reliable one. *See infra* Sections I.A.-I.C.

A fundamental question is: how did the SBS Hypothesis gain widespread acceptance if it is, as the trial court concluded, merely "junk science"? A closer examination of the adoption of the SBS Hypothesis has revealed that serious methodological flaws in the medical literature, chief among them selection and confirmation bias, were ignored or overlooked in an understandable but ultimately misguided effort to protect infants from potentially abusive situations. *See infra* Section II. A systematic review of the literature has revealed that there is "limited scientific evidence that the triad and therefore its components can be associated with traumatic shaking (low quality evidence)" and "insufficient scientific evidence on which to assess the diagnostic accuracy of the triad in identifying traumatic shaking (very low quality evidence)."[3] Further, the SBS Hypothesis, unlike a traditional medical diagnosis, is not typical in that it is not used for treatment based on physical findings but rather serves a purely legal function: to identify abuse.

Thus, while it is not disputed that shaking can injure an infant and should be avoided, conclusions that the mere existence

[3] Swedish Agency for Health Technology Assessment and Assessment of Social Services, *Traumatic Shaking: The Role of the Triad in Medical Investigations of Suspected Traumatic Shaking—A Systematic Review* 5 (2016) [hereinafter SBU Assessment], https://www.sbu.se/255e.

of the triad demonstrates that an infant was abusively shaken are incompatible with both science and the ethical obligations of medical professionals.[4] Though some doctors still advance the SBS Hypothesis as fact, confidence in the SBS Hypothesis has eroded over time and it is no longer generally accepted in the relevant scientific community. Indeed, even the staunchest proponents of the hypothesis concede that fatal flaws undermine its use as a diagnosis – distancing themselves from using the triad terminology in their official advocacy while relying on it to diagnose abuse based on the SBS Hypothesis. *See infra* Sections II-III.

Notably, this is not the first time that a medical hypothesis has been widely adopted without the necessary scientific validation and subsequently exposed as "junk science" through re-evaluation of the medical literature and advancements in scientific understanding. Just as doctors (wrongly) adopted the SBS Hypothesis because they could not find another cause for the triad, doctors also (wrongly) believed for years that stomach ulcers were caused by stress because they were unable to find another cause.[5] It has since been determined that ulcers are predominately caused not by stress but by bacterial infections.[6]

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[4] *See* SBU Assessment, *supra* note 3, at App'x 3.

[5] Keith A. Findley et al., *Shaken Baby Syndrome, Abusive Head Trauma, and Actual Innocence: Getting it Right*, 12 Hous. J. Health L. & Pol'y 209, 277 (2012).

[6] *Id.*

Another example of debunked "junk science" was the belief that infants should sleep in prone position -- a belief that the medical community dropped virtually overnight after the publication of a single article recommending that infants be positioned on their side or back to avoid Sudden Infant Death Syndrome ("SIDS").[7] Even the SBS Hypothesis itself has undergone reevaluation: though adopted, in part, on the premise that a short fall could not cause the triad; it has now been conclusively proven that short falls *can* cause the triad. *Infra* Section I.A.

That a theory was once widely accepted as fact does not make it valid - science is neither static nor democratic. The SBS Hypothesis is not supported by reliable scientific evidence and no longer generally accepted in the relevant scientific community. As such, from a medical perspective, the trial court's rejection of testimony regarding Shaken Baby Syndrome/Abusive Head Trauma should not be controversial.

Statement of Facts and Procedural History

As the Court is aware, this matter arises from an order barring the admission of expert testimony regarding "Shaken Baby Syndrome/Abusive Head Trauma." For additional details, Amici rely on the parties' briefs.

[7] AAP Task Force on Infant Positioning and SIDS, *Positioning and SIDS*, 89 Pediatrics 1120, 1120(1992).

Argument

I. There is no scientific basis for an SBS "diagnosis."

The SBS Hypothesis posits that when an infant has the triad of three findings or one of its components - (i) subdural hematoma, (ii) retinal hemorrhage, and (iii) cerebral edema - it can be presumed that the infant's injuries are due to abusive shaking by the person who was with the infant when the infant's symptoms arose. The SBS Hypothesis is based on two underlying assumptions. First, it assumes that shaking a child could produce sufficient force to cause each element of the triad. And second, it assumes that shaking is the *only* explanation for the presence of the triad. Neither of these assumptions is based in science. And, even worse, the SBS "diagnosis" requires physicians to make conclusions based not on their medical training but rather on speculation not only as to what might have caused the triad (i.e., shaking), but also the intent of the person accused – speculation that is seen nowhere else in medicine.

A. There are no scientific or bio-mechanical studies validating the hypothesis that abusive shaking can cause the triad.

Despite the historical prominence of the SBS Hypothesis, there are zero scientific or bio-mechanical studies validating the hypothesis that abusive shaking can produce sufficient force to cause the triad. Notably, this absence of scientific validation

is not due to a lack of effort by proponents of the SBS Hypothesis.[8] Since the late 1980s, there have been numerous attempts to prove that shaking an infant produces sufficient force to cause the triad.[9] However, none of those attempts has been successful; no study produced reliable evidence that shaking generates the acceleration-deceleration forces necessary to cause the triad.[10]

To the contrary, recent studies indicate that shaking an infant produces only a small fraction of the force necessary to cause the triad. In one study, a team of biomechanical engineers conducted experiments designed to compare the relative accelerations created by different methods of producing rotational forces – that is, different methods of shaking — that yield brain injuries.[11] The experiments demonstrated that *none* of various forms of shaking tested was sufficient to cause subdural hemorrhages in an infant.[12] Even studies published by proponents of the SBS Hypothesis fail to provide a scientific basis for the

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[8] *See* Randy Papetti et al., *Outside the Echo Chamber: A Response to the "Consensus Statement on Abusive Head Trauma in Infants and Young Children,"* 59 Santa Clara L. Rev. 299 (2019)(describing and citing academic literature and studies conducted in support of the SBS Hypothesis).

[9] *Id.* at 312-13.

[10] *See* Michael D. Jones et al., *Development of a Computational Biomechanical Infant Model for the Investigation of Infant Head Injury by Shaking*, 55 Med. Sci. L. 291, 292, 296-97 (2015).

[11] *See* Michael T. Prange et al., *Anthropomorphic Simulations of Falls, Shakes, and Inflicted Impacts in Infants*, 99 J. Neurosurgery 143, 149 (2003)

[12] *See id.*

hypothesis. In 1987, Dr. Ann-Christine Duhaime, a leading figure in the SBS community, "constructed models of infants with various neck and head properties in order to measure the forces created by shaking and impact."[13] Duhaime's team measured the forces generated as the models were aggressively shaken by volunteers. The results demonstrated that "no matter how hard the volunteers shook the models, the shaking did not generate acceleration measurements anywhere near those estimated as necessary to tear cortical bridging veins and cause subdural hemorrhage or other intracranial injury."[14]

This is consistent with more recent research confirming that abusive shaking does not generate enough force to cause the triad in infants. In 2015, biomechanical engineers concluded, based on an experiment involving monkeys, that the minimum "rotational acceleration to cause traumatic shaking injury would be about 4,000 radian/sec^2."[15] In Duhaime's study, the volunteers' aggressive shaking of the dolls produced a rotational acceleration of only

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[13] Papetti et al., *supra* note 8, at 312.

[14] *Id.*

[15] Marvin Miller, *Application of Hill's criteria of causation to shaken baby syndrome: Further evidence that questions the existence of shaken baby syndrome*, 1 J. of Biomedical Eng'g and Informatics 1,4 (2015). Radians per second is a measurement of rotational accelerations. *Id.*

1,139 radian/sec^2, a measure far below the 4,000 radian/sec^2 required to cause a traumatic shaking injury.[16]

Furthermore, there is evidence that the magnitude of force needed to cause intracranial brain damage, would likely cause severe neck injuries.[17] But such injuries are "conspicuous[ly]" absent in "most cases of SBS."[18] A 1968 study subjecting monkeys to significant rotational acceleration "found that 11 of the 19 adult monkeys had neck injuries."[19] Given that monkeys "have greater neck musculature than human infants," one would expect a much greater percentage of "shaken" infants to display neck injuries.[20] Thus, when an infant does not have neck injuries, as is true in most cases where SBS has been diagnosed, "violent shaking is not a plausible explanation."[21] The child in this case, D.N., did not have a neck injury.[22]

In contrast to the studies demonstrating that *shaking* is not a plausible explanation for the triad in the absence of a neck

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[16] *Id.*

[17] *Id.*

[18] *Id.*

[19] *Id.*

[20] *Id.*

[21] *Id.* at 5.

[22] *See* Transcript of Frye Hearing, September 24, 2020, 164-13 to 165-12.

injury, it is now generally accepted that short falls *are*.[23] Numerous biomechanical studies have demonstrated that the rotational force caused by a minor (or "short") fall, unlike that caused by shaking, can generate sufficient force to cause the triad. For instance, one study by Ommaya et al. in 2002 found that a three to four foot fall "generates a load about 10 times greater than can be achieved by SBS."[24] Moreover, the research demonstrates not only that short falls generate significantly greater force than shaking, but also that "subdural hematomas, retinal hemorrhages, and other forms of significant head injury can result from accidental short falls," that is, that short falls can cause the triad."[25]

B. Every component of the triad has numerous non-abusive causes.

Recent advancements in scientific and medical research have established that each component of the triad is attributable to a wide variety of non-abusive causes.

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[23] *See* Findley et al., *Getting it Right*, *supra* note 5, at 257.

[24] Ayub K. Ommaya et al., *Biomechanics and Neuropathology of Adult and Paediatric Head Injury*, 16 British J. Neurosurgery 220, 226 (2002).

[25] *Commonwealth* v. *Epps*, 53 N.E.3d 1247, 1264 (Mass. 2016); *see also,* Norrell Atkinson et al., *Childhood Falls with Occipital Impacts*, 34 Pediatric Emergency Care 837, 840 (2018); *see also* Brian K. Holmgren, *Ethical Issues in Forensic Testimony Involving Abusive Head Trauma*, 3 Acad. Forensic Pathology 317, 319 (2013) (outspoken prosecutor supporting the SBS Hypothesis has acknowledged that accidental short falls can sometimes, although rarely, produce triad-like symptoms).

Several studies have found that subdural hematomas can be caused by a variety of accidental and genetic causes unrelated to trauma. For example, the American Heart Association identified Cerebral Venous Thrombosis ("CVST"), a type of stroke most prevalent in early infancy,[26] as a cause of subdural hematoma and retinal hemorrhages.[27] Additionally, there is growing evidence that children with benign enlargement of the subarachnoid spaces ("BESS"), a condition in which excess fluid accumulates outside the brain or in the subdural space,[28] may develop subdural and retinal hemorrhage spontaneously or "after only minor accidental trauma."[29] Moreover, it is now understood that there are myriad other accidental and natural causes of subdural hematomas, including short falls, prenatal conditions, congenital vascular malformations, birth trauma, genetic and metabolic disorders, clotting disorders, infectious diseases (such as

[26] Papetti et al., *supra* note 8, at 344.

[27] *See* E. Steve Roach et al., *Management of Stroke in Infants and Children*, 39 Stroke 2644, 2668 (2008); Gil Binenbaum et al., *Patterns of retinal hemorrhage associated with pediatric cerebral sinovenous thrombosis*, 21 J. of AAPOS 23 (2017).

[28] Papetti et al., *supra* note 8, at 346-47.

[29] *Id.* 349 (citing Ulf Högberg et al., *Epidemiology of Subdural Haemorrhage During Infancy: A Population-Based Register Study*, PLoS ONE, October 31, 2018).

meningoencephalitis), and acute or progressive atrophy of the brain from various causes.[30]

Likewise, studies demonstrate that retinal hemorrhages are associated with a variety of accidental and natural causes.[31] Research has shown that retinal hemorrhages are not diagnostic of shaking, exclusively, but rather "can be caused by all kinds of other insults to the head" such as cerebral edema and advanced cardiac life support, meningitis, prematurity/congenital heart disease, in utero intracranial hemorrhage, apnea/gastroesophageal reflux, SIDS/resuscitation, disseminated intravascular coagulation, cerebral vein thrombosis, high blood pressure, cardiopulmonary resuscitation, seizures, and birth-related causes.[32] Even supporters of the SBS Hypothesis have acknowledged that retinal hemorrhaging is not exclusive to abusive head trauma.[33] For example, in 2011, Narang found that non-abusive causes for retinal hemorrhages include accidents, genetic or

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[30] *See* Lori Frasier et al., *Abusive Head Trauma in Infants and Children: A Medical, Legal, and Forensic Reference* 129-226(2006); *see also* Atkinson et al., *supra* note 25, at 840.

[31] SBU Assessment, *supra* note 3, at 12.

[32] *See* Keith A. Findley et al., *Examining Shaken Baby Syndrome Convictions in Light of New Medical Scientific Research*, 37 Okla. City U. L. Rev. 219, 227 (2012) (citing studies)

[33] *See* Alex V. Levin & Cindy W. Christian, *The Eye Examination in the Evaluation of Child Abuse*, 126 Pediatrics 376, 376 (2010) ("Although RHs are an important indicator of possible AHT, they are also found in other conditions.").

metabolic conditions, anemia, hypoxia, clotting disorders, increased intracranial pressure, and meningitis.[34]

Furthermore, research concerning the hypothesis that shaking can cause retinal hemorrhages has failed to validate it.[35] Because non-abusive causes are a "far more likely explanation for [retinal hemorrhages] than shaking,"[36] the presence of retinal hemorrhages is of limited value in the investigation of suspected infant abuse and is insufficient to determine the presence of inflicted injury.[37]

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[34] *See* Sandeep K. Narang, *A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome*, 11 Hous. J. Health L. & Pol'y 505, App'x C (2011).

[35] *See generally*, Brittany Coates et al., *Ocular Hemorrhages in Neonatal Porcine Eyes from Single, Rapid Rotational Events*, 51 Investigative Ophthalmology & Visual Sci. 4792 (2010) (Piglets subjected to rotational accelerations/decelerations of greater than 50 times what might be generated by abusive shaking did not develop any significant grossly visible retinal hemorrhages, blood filled schisis cavities (over the macula or elsewhere), or retinal folds.); John 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 (2010) (Lambs subjected to repetitive abusive shaking did not develop significant grossly visible retinal hemorrhages, blood filled schisis cavities (over the macula or elsewhere), or retinal folds (much less retinal tears).); John 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)(same); Brittany Coates et al., *Cyclic Head Rotations Produce Modest Brain Injury in Infant Piglets*, 34 J. of Neurotrauma 235 (2017) (Piglets subjected to up to one minute of repetitive head acceleration/decelerations at levels equivalent to what might be generated in an abusive shaking of infant did not develop any eye findings).

[36] Waney Squier, *Infant Retinal Haemorrhages Correlate with Chronic Subdural Haemorrhage, Not Shaking*, 111 Acta Paediatrica 714, 715 (2022).

[37] *See* Ingemar Thiblin et al., *Retinal hemorrhage in infants investigated for suspected maltreatment is strongly correlated with intracranial pathology*, 111 Acta Paediatrica 800, 806 (2022); Ingemar Thiblin et al., *Medical findings and symptoms in infants exposed to witnessed or admitted abusive shaking: A nationwide registry study*, PLoS ONE, October 13, 2020, 2.

Research has also found that cerebral edema is not significantly associated with AHT.[38] Originally, proponents of the SBS Hypothesis thought that encephalopathy (brain damage) was due to the tearing of axons (nerve fibers in the brain) caused by shaking. However, current research indicates such brain findings reflect deprivation of oxygen or oxygenated blood to the brain (i.e., hypoxia-ischemia) rather than trauma and, therefore, do not necessarily – or even usually – indicate trauma.[39]

As even continued proponents of the SBS Hypothesis agree, abusive shaking can be asserted as a potential explanation for an infant's condition only after every non-abusive potential cause of the components of the "triad" has been be ruled out.[40] And even then, it is not appropriate for shaking to be "ruled in" as the cause of an infant's triad of findings because, as discussed above, such a finding has never been scientifically established.

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[38] *See* Shalea J. Piteau et al., *Clinical and Radiographic Characteristics Associated with Abusive and Nonabusive Head Trauma: A Systematic Review*, 130 Pediatrics 315, 319 (2012).

[39] Papetti et al., *supra* note 8, at 333.

[40] Arabinda Kumar Choudhary et al., *Consensus Statement on Abusive Head Trauma in Infants and Young Children*, 48 Pediatric Radiology 1048, 1048, 1060 (2018) [hereinafter Consensus Statement]**Error! Hyperlink reference not valid.**("The workup must exclude medical diseases that can mimic AHT. . . . Each infant suspected of suffering AHT must be further evaluated for other diseases that might present with similar findings."); Sandeep K. Narang et al., *Abusive Head Trauma in Infants and Children*, 145 Pediatrics 1, 2 (2020) (warning that "[m]edical diseases that can mimic the findings commonly seen in AHT are increasingly recognized," so "[p]ediatric practitioners should be cautious to not overstate the significance of particular medical findings").

C. "Shaken Baby Syndrome" is not a medical diagnosis.

At bottom, SBS or AHT is not a medical diagnosis that doctors are able to make, much less a valid one. A medical diagnosis "refers to the process of determining the disease or dysfunctional condition from which a patient suffers in order to determine the best course of treatment . . . ."[41] An SBS "diagnosis," however, is an opinion as to the *cause* of that condition. In rendering an opinion that a child has suffered from abusive shaking based on the presence of intracranial injury, child abuse physicians "assume they know how the patient" acquired the injury.[42] Whereas the diagnosis consistent with the medical definition of the word would be "brain injury," which could be genetic, environmental, accidental, or intentional, the SBS "diagnosis" involves a determination of the *cause* of that diagnosis, i.e., that the child was intentionally harmed. This kind of causation inquiry is grounded entirely in conjecture and, as such, exceeds the training and expertise of clinical physicians.[43]

SBS diagnoses often also go one step further and purport to determine *who* abusively shook the infant by assuming that the person whom the infant was with when first becoming symptomatic

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[41] Keith A. Findley et al., *Feigned Consensus: Usurping the Law in Shaken Baby Syndrome/Abusive Head Trauma Prosecutions*, 4 Wis. L. Rev. 1211, 1238–39 (2019).

[42] *Id.* at 1240.

[43] *Id.* at 1238, 1241.

must have caused the injuries. But such determinations are completely speculative because infants may not become immediately symptomatic after injury - research suggests that over 25% of infants in alleged SBS/AHT cases had a lucid interval of over 24 hours between trauma and collapse, with some infants having a lucid interval of over 72 hours.[44] Thus, even if the science could support a conclusion that an infant with the triad has been abusively shaken (which it cannot for the reasons described above), one cannot conclude that the person who had physical custody of the infant when the infant became symptomatic was the infant's abuser.

Whether an act was committed, by whom, and what their mindset was are quintessential legal questions and decidedly not medical diagnoses or medical opinions.[45] Yet, as one observer suggests, an SBS "diagnosis" is essentially a "medical diagnosis of murder."[46] Because making such a "diagnosis" is beyond the

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[44] M.G.F. Gilliland, *Interval Duration Between Injury and Severe Symptoms in Nonaccidental Head Trauma in Infants and Young Children*, 43 J. Forensic Sci. 723, 723 (1998). *See also* Kristy B. Arbogast et al., *Initial Neurologic Presentation in Young Children Sustaining Inflicted and Unintentional Fatal Head Injuries*, 116 Pediatrics 180, 180 (2005) (infants or toddlers may sustain a fatal head injury yet present to hospital clinicians as lucid before death); Scott Denton & Darinka Mileusnic, *Delayed Sudden Death in an Infant Following an Accidental Fall, A Case Report with Review of the Literature*, 24 Am. J. Forensic Med. Pathology 371 (2003) (discussing nine-month-old acting normally for 72 hours after fall before death).

[45] *See* Findley et al., *Feigned Consensus*, *supra* note 41 at 1246-1248.

[46] Deborah Tuerkheimer, The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts, 87 Wash. U. L. Rev. 1, 5 (2011).

expertise of clinical physicians and is based on assumptions that have either never been validated or already shown to be false, SBS diagnoses are "incompatible" with doctors' professional ethics.[47]

II. Past acceptance of the SBS Hypothesis may have been based on good intentions, but was bad science.

A close analysis of the history of the SBS hypothesis is instructive in understanding how its acceptance became so prevalent despite its lack of scientific support.

A. The SBS Hypothesis was adopted based on the misapplication of animal studies and circular reasoning.

The SBS Hypothesis was first posited in 1971 by pediatric neurosurgeon Dr. Arthur Norman Guthkelch.[48] Guthkelch found that in two cases where a child had an unexplained subdural hematoma and no signs of impact, the mother of the infant had confessed to shaking the infant.[49] He further noted that in an animal experiment, Ommaya had demonstrated that forceful whiplash could cause intracranial injuries in monkeys.[50] Based on this evidence, Guthkelch extrapolated that unexplained subdural hematomas in infants may be the result of traumatic shaking.[51] Over the next

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[47] SBU Assessment, *supra* note 3 at App'x 3.

[48] A. N. Guthkelch, *Infantile Subdural Haematoma and its Relationship to Whiplash Injuries*, 2 British Med. J. 430 (1971).

[49] *Id.* at 431.

[50] *Id.*

[51] *Id.*

three years, Dr. John Caffey, a long-time advocate against child abuse, published three papers elaborating on Guthkelch's hypothesis, ultimately concluding that shaking can be presumed when there are no "external signs of trauma" and an infant's subdural and retinal bleeding cannot be explained by other causes.[52]

However, the only scientific studies that Guthkelch and Caffey relied upon to support their hypothesis were Ommaya's monkey studies, which they plainly misapplied.[53] While Ommaya's studies had shown that high velocity impacts can cause intracranial injuries in monkeys, the force generated in Ommaya's studies was *40* times the force that humans can generate from shaking.[54] Furthermore, Ommaya's studies had shown that whiplash injuries would cause neck trauma in addition to intracranial injury - a finding noticeably absent in most purported SBS cases. Guthkelch's and Caffey's extrapolations from the Ommaya studies were

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[52] *See* John Caffey, *The Parental-Infant Traumatic Stress Syndrome; (Caffey-Kempe Syndrome), (Battered Babe Syndrome)*, 114 Am. J. Roentgenology 218 (1972); John Caffey, *On the Theory and Practice of Shaking Infants*, 124 Am. J. of Diseases Of Child. 161 (1972); 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 (1974).

[53] *See* Steven C. Gabaeff, *Challenging the Pathophysiologic Connection Between Subdural Hematoma, Retinal Hemorrhage and Shaken Baby Syndrome*, 12 W. J. of Emergency Med. 144, 145-46 (2011) [hereinafter Gabaeff 2011].

[54] *Id.* at 146.

subsequently discredited including by Ommaya himself.[55] Notably, Guthkelch's and Caffey's hypothesis also ignored studies already existing at the time that provided alternative, non-abusive causes for the triad components.[56]

Unfortunately, despite the lack of evidentiary support for the hypothesis, it quickly gained widespread acceptance in the pediatric medical community, presumably from well-intentioned, but ultimately misguided, attempt to protect children from child abuse. Because there was (and still is) no test for determining whether an infant had been abused, clinical physicians latched onto the SBS Hypothesis, along with medical histories, to identify cases of suspected abuse.

However, much of the initial research suffered from a serious problem with selection bias - improperly excluding infants with a history of major trauma from consideration - resulting in a skewed correlation between the "triad" and infants suffering from

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[55] *See supra* Section I.A.; Gabaeff 2011, *supra* note 53, at 145; 2; Ayub K. Ommaya et al., *Biomechanics and Neuropathology of Adult and Paediatric Head Injury*, 16 British J. Neurosurgery 220 (2002) (explaining that Guthkelch and Caffey had misunderstood his monkey studies).

[56] *See e.g.*, Robert W. Hollenhorst et al., *Ocular Signs and Prognosis in Subdural and Subarachnoid Bleeding in Young Children*, 60 Archives of Opthalmology 187 (1958) (noting that retinal and subhyaloid hemorrhage are common findings in infants from a variety of causes); Gabaeff 2011, *supra* note 53, at 145 ("Their theory did not consider the significant literature (discussed below) that had established that intracranial hemorrhage and increased intracranial pressures (ICP), without impact or shaking, are well-documented causes of RH [retinal hemorrhages].") (citing several studies pre-dating 1971 along with later studies); A. N. Guthkelch, *Subdural Effusions in Infancy: 24 Cases*, 1 British Med. J. 233 (1953); Franc D. Ingraham & Donald D. Matson, *Subdural Hematoma in Infancy*, 24 J. Pediatrics 1, 3 (1944).

suspected abuse.[57] For example, a 2008 study by Rafaat examined 156 patients in a drowning registry and found that those children did not present with intra-axial or extra-axial bleeding. The study concluded that the CT scans of patients with drowning "differ from those of patients who have suffered abusive head trauma." This study suffers from selection bias – by concluding that a small sample of patients with non-abusive injuries must be different from a category of "abused" patients that was excluded from the study. Critically, this study did not include patients "if they had known pre-existing CT abnormalities or if they presented with evidence of trauma." Thus, if an infant had suffered from drowning and also had "evidence of trauma" (i.e. subdural hematoma from the perspective of SBS Hypothesis advocates), such infant would have been automatically excluded from this study.

Failing to recognize the circular reasoning and other methodological flaws underlying these studies, SBS proponents used them as further support for the SBS Hypothesis. By the late 1970s, papers were published arguing that subdural and retinal hemorrhages were not only *associated* with shaking but could have

[57] *See, e.g.*, Papetti et al., *supra* note 8, at 335.

been caused *only* by shaking or violent abuse.[58] By 1993, abuse was presumed whenever a child presented with the "triad."[59]

B. The shift to evidence-based medicine exposed the dearth of reliable literature supporting the SBS Hypothesis.

The arrival of evidence-based medicine standards in the late 1990s triggered a review of the evidence purportedly supporting the SBS Hypothesis to ensure it was based on scientific and statistically rigorous standards. The core precept of evidence-based medicine is that "medical understandings should be based on the best available evidence that has been gathered and analyzed reliably rather than on historic practice or claimed expertise."[60] The SBS literature did not hold up to evidence-based medicine's scrutiny – in part because the SBS Hypothesis is untestable because there can never be a control group (and rightfully so, as it would be unethical to deliberately shake a child).

More specifically, analyses of the SBS literature since the adoption of evidence-based medicine have revealed numerous methodological flaws that gave it the false appearance of validity, and allowed its widespread adoption. As previewed, the "most

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[58] *Id.* at 305.

[59] *See* Committee on Child Abuse and Neglect (COCAN) of the American Academy of Pediatrics (AAP), *Shaken Baby Syndrome: Inflicted Cerebral Trauma*, 92 Pediatrics 872 (1993); *see also* Committee on Child Abuse and Neglect (COCAN) of the American Academy of Pediatrics (AAP), *Shaken Baby Syndrome: Rotational Cranial Injuries-Technical Report*, 108 Pediatrics 206 (2001).

[60] Papetti et al., *supra* note 8, at 362.

pervasive flaw" in the literature is circular reasoning and selection bias: because physicians used the SBS Hypothesis to determine whether an infant was abused, it was self-fulfilling that the studies would find a high association between abuse and subdural and retinal hemorrhages, but a low association between those hemorrhages and accidental trauma.[61] These flaws undermine virtually all of the SBS/AHT literature.[62] Other methodological flaws common in SBS research include:

1. Obfuscation of the alleged mechanism of abuse. Some studies have adopted broad terminology, such as "inflicted head injury" or "Abusive Head Trauma," that could refer to two possible mechanisms of injury: shaking or impact to the head. Without being

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[61] *See* Papetti et al., *supra* note 8, at 335; *see also, e.g.*, SBU Assessment, *supra* note 3, at 29-30 (explaining the problem of circular reasoning in the SBS literature); Findley et al., *Feigned Consensus*, *supra* note 41, at 165 ("It is now recognized that the SBS/AHT literature is based largely on studies that used circular and self-fulfilling methodology—e.g., subdural and retinal hemorrhages were used as primary diagnostic and classification criteria for SBA/AHT in studies that then reported an extremely high rate of such hemorrhages in SBS/AHT."); Mark Donohoe, *Evidence-based medicine and shaken baby syndrome. Part 1: literature review. 1966-1998*, 24 Am. J. Forensic Med. and Pathology 239, 241 (2003) ("Many studies lacking these critical data make the obvious logical error of selecting cases by the presence of the very clinical findings and test results they seek to validate as diagnostic. Not surprisingly, such studies tend to find their own case selection criteria pathognomonic of SBS."); Shalea J. Piteau et al., *Clinical and Radiographic Characteristics Associated with Abusive and Nonabusive Head Trauma: A Systematic Review*, 130 Pediatrics 315, 321 (2012), ("As there are no standardized criteria for the definition of abuse, most authors developed their own criteria, and many of these are fraught with circular reasoning."); Findley et al., *Getting it Right*, *supra* note 5, at 273-75 ("As even a brief review of the literature suggests, the numerous studies that have concluded SBS/AHT is a frequent cause of the triad and that subdural hematomas and retinal hemorrhages are reliable indicators of abuse have methodological flaws that range from circularity to statistical mishaps. The primary defect is that virtually all of the SBS/AHT literature is circular.").

[62] *See* Papetti et al., *supra* note 8, at 335.

able to distinguish between the alleged mechanism of injury in such studies, they are unhelpful in evaluating or validating the SBS Hypothesis.[63]

2. Uncertain classification of "shaking" cases. Identifying cases of abusive, as opposed to accidental, shaking for the purposes of study is inherently problematic, given that traumatic shaking is often unwitnessed, and there is a demonstrated risk of false confessions in these types of cases.[64] That much of this data relies on the use of confession statements is particularly problematic as confessions are not scientific evidence.[65] Further, the quantity of data available from confession-based studies is insufficient to permit valid statistical analysis or provide support for many of the commonly stated aspects of SBS.[66]

3. Confirmation bias. Some studies have ignored their own data undermining the SBS Hypothesis, either rejecting that data as false or drawing unsupported conclusions from it. For example, one author reviewed hospital records of children reported to have fallen from various heights and found an unexpectedly large number of deaths after reported short falls. Rather than accept that

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[63] SBU Assessment, *supra* note 3, at 28-29.

[64] *Id.* at 29.

[65] Papetti et al., *supra* note 8, at 341.

[66] Findley et al., *Getting it Right*, *supra* note 5, at 258.

data as undermining the then-held belief that short falls could not be fatal, the author determined that the event histories for those children must be false.[67]

4. Clinical judgment. The SBS "diagnosis" is subjective and dependent on clinical judgment, which necessarily varies among clinicians. "With no history to correlate with the findings and no treatment that would confirm the diagnosis, the SBS/AHT diagnosis lacks the safeguards that gird most clinical diagnoses . . . ."[68]

In 2016, a panel of leading experts appointed by the Swedish Agency for Health Technology Assessment and Assessment of Social Services conducted a systematic review of the SBS/AHT medical literature (referred to as the "SBU Assessment," based on its Swedish acronym).[69] This project group included professors in pediatrics, forensic medicine, neonatology, family medicine, diagnostic radiology and neuroradiology, medical ethics, and medical technology as well as external scientific reviewers who

[67] David L. Chadwick et al., *Deaths from Falls in Children: How Far Is Fatal?*, 31 J. Trauma 1353, 1353, 1355 (1991).

[68] Findley et al., *Getting it Right*, *supra* note 5, at 281; *see also* SBU Assessment, *supra* note 3, at 30 ("In both controlled experimental and observational studies, systematic errors can occur because various observers do not always make the same observations and/or interpret the observations differently.").

[69] SBU Assessment, *supra* note 3.

contributed to the report.[70] Of the 3,773 medical papers reviewed as part of the SBU Assessment, 1,065 were identified as relevant to the SBS Hypothesis, yet "only thirty met the inclusion criteria of potentially providing evidence on the diagnostic value of the triad, and of those, only two were moderate quality; none were of high quality; and all the rest were low quality."[71] From these results, the SBU Assessment concluded that there is "limited scientific evidence that the triad and therefore its components can be associated with traumatic shaking (low quality evidence)" and "insufficient scientific evidence on which to assess the diagnostic accuracy of the triad in identifying traumatic shaking (very low quality evidence)."[72] These conclusions reaffirmed a prior determination by Dr. Mark Donohoe, published in the American Journal of Forensic Pathology in 2003, that the SBS hypothesis was scientifically "unsustainable" because the literature contained "inadequate scientific evidence to come to a firm conclusion on most aspects of causation, diagnosis, treatment, or any other matters pertaining to SBS."[73]

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[70] *Id.* at 37-38.

[71] Findley et al., *Feigned Consensus*, *supra* note 41, at 1232 (summarizing the SBU Assessment).

[72] SBU Assessment, *supra* note 3, at 5.

[73] Donohoe, *supra* note 61, at 241.

As the focus on evidence-based medicine exposed the lack of reliable support for the SBS Hypothesis, the revelations concerning the basic design flaws inherent in the historical research purporting to support the SBS Hypothesis forced even its prominent supporters to acknowledge its shaky foundations. In 2002, supporters of the hypothesis at the NIH conference "repeatedly acknowledged" the "lack of evidentiary support for SBS."[74] In 2009, the Committee on Child Abuse and Neglect of the American Academy of Pediatrics ("COCAN") revised position papers on the SBS Hypothesis written in 1993 and 2001, noting that "advances in the understanding of the mechanisms and clinical spectrum of injury associated with abusive head trauma" showed that "the mechanisms and resultant injuries of accidental and abusive head injury overlap" and "there is no single or simple test to determine the accuracy of the diagnosis . . . ." [75] COCAN also removed two critical assumptions discussed in the 2001 paper: (1) the presumption of abuse for infants with intracranial injury; and (2) the assumption that short falls do not cause the symptoms attributed to SBS. In 2011, a prominent supporter of the SBS Hypothesis acknowledged in a child abuse textbook that "nobody has yet marshaled a coherent and comprehensive argument in support of

[74] Findley et al., *Getting it Right*, *supra* note 5, at 234.

[75] Cindy W. Christian et al., *Abusive Head Trauma in Infants and Children*, 123 Pediatrics 1409, 1410 (2009).

shaking as a causal mechanism for abusive head injury."[76] In the same year, another prominent SBS Hypothesis supporter publicly stated: "No trained pediatrician thinks that subdural hemorrhage, retinal hemorrhage and encephalopathy equals abuse. The 'triad' is a myth!"[77] In 2020, COCAN noted that "[m]edical diseases that can mimic the findings commonly seen in AHT are increasingly recognized" and "there is not a particular pattern of cranial injury unique to AHT," cautioning "[p]ediatric practitioners [to] be cautious to not overstate the significance of particular medical findings."[78]

Even Guthkelch himself, the founder of the SBS Hypothesis, has expressed concern over the prevalent use of his hypothesis as a scientific fact.[79] In 2012, Guthkelch published an article warning that it "does not follow . . . that one can infer shaking (or any other form of abuse) from a finding of retino-dural hemorrhage in infancy."[80] As Guthkelch explained in his article,

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[76] Mark S. Dias, *The Case for Shaking, in Child Abuse and Neglect: Diagnosis, Treatment, and Evidence* 364 (2011).

[77] Findley et al., *Getting it Right*, *supra* note 5, at 244.

[78] Sandeep K. Narang et al., *Abusive Head Trauma in Infants and Children*, 145 Pediatrics 1, 5 (2020).

[79] *See* A. N. Guthkelch, *Problems of Infant Retino-Dural Hemorrhage with Minimal External Injury*, 12 Hous. J. Health L. & Pol'y 201, 206-07 (2012).

[80] *Id.* at 203.

and the above analysis has shown: "SBS and AHT . . . are simply hypotheses, not proven medical or scientific facts."[81]

III. The SBS Hypothesis is not generally accepted in the relevant scientific community.

In light of both the new research and the re-evaluations of the literature purporting to support the SBS Hypothesis, it is clear that the SBS Hypothesis is no longer generally accepted in the relevant scientific community. The relevant scientific community is significantly broader than the subset of doctors counted as "child abuse pediatricians," who continue to serve as experts for prosecutors and/or write literature aimed at lobbying courts to accept SBS/AHT diagnoses. Because the SBS Hypothesis posits a connection between a mechanical force and injuries to multiple parts of an infant's body, the relevant scientific community includes biomechanical scientists, pediatricians, radiologists, neurosurgeons, neuroradiologists, ophthalmologists, neuro-ophthalmologists, neurologists, and pathologists, among others.[82] The first group, biomechanical scientists, have published numerous articles concluding that even vigorous shaking alone cannot generate sufficient force to produce the brain injury

[81] *Id.* at 203-04, 207.

[82] Proponents of SBS diagnoses acknowledge that a wide array of subspecialties are relevant to evaluating whether an infant has SBS/AHT. *See, e.g.*, Frasier et al., *supra* note 30, at 2 ("Subspecialists in radiology, neurology, general pediatric surgery, and other fields should also be consulted when necessary to ensure a complete and accurate evaluation.").

thresholds. And there is widespread recognition by the members of the relevant medical specialties that have studied the issue that there are natural and accidental causes for the findings previously attributed to SBS. Indeed, as of 2016, only about forty percent of pathologists - the group of doctors actually trained to assess cause of death - view SBS as a valid potential diagnosis.[83] Even previous proponents of SBS have retracted previous views or expressed concerns regarding the reliability of SBS as a diagnosis. Thus, there is no longer general acceptance in the relevant scientific community of the theory that the presence of the triad, without other findings indicative of abuse, is sufficient to diagnose child abuse.

There remains a subset of scientists who continue to advocate for the use of the SBS Hypothesis as a diagnostic tool for child abuse. This subset – a small but vocal minority - has repeatedly ignored critical aspects of evidence and utilized misleading language to support its position. In 2018, this subset published what it deemed a "Consensus Statement" to advocate its continued support of the SBS Hypothesis as a reliable and conclusive diagnostic tool.[84] The Consensus Statement is deeply misleading

[83] *See* Sandeep K. Narang et al., *Acceptance of Shaken Baby Syndrome and Abusive Head Trauma as Medical Diagnoses*, 177 J. Pediatrics 273, 275 (2016).

[84] *See* Consensus Statement, *supra* note 40.

and unreliable – and is far from a "consensus" of the scientific community.

Despite its name, the Consensus Statement fails to reflect a consensus of the pediatric, radiology, and neuroradiology groups that supposedly "endorsed" it, much less a consensus more generally among pediatricians, radiologists, neuroradiologists, or other specialties within the relevant scientific community. The Consensus Statement was not even approved or voted on by a majority of the membership of the group that published it: the Society for Pediatric Radiology ("SPR").[85] Members of the SPR were provided only ten days to submit a response to the Consensus Statement and, although at least two members of the SPR submitted a response identifying many areas of disagreement, the SPR ignored those criticisms and proceeded to publish the Consensus Statement as reflecting a "consensus" view.[86] The SPR also cited a survey of physicians who reported strong support among "child-abuse physicians" for a SBS diagnosis - however, this result is not shocking given that the survey was targeted to physicians "most commonly involved in suspected AHT cases."[87] And even in this

[85] Findley et al., *Feigned Consensus*, *supra* note 41, at 1226. The Consensus Statement was instead endorsed by the 15-person SPR Child Abuse Imaging Committee. Consensus Statement, *supra* note 40 at 1050.

[86] *Id.* at 1228.

[87] Consensus Statement, *supra* note 40, at 1051 (citing Sandeep K. Narang et al., *Acceptance of Shaken Baby Syndrome and Abusive Head Trauma as Medical Diagnoses*, 177 J. Pediatrics 273 (2016)).

survey, pathologists (who are trained in assessing the cause of death or injury) were "statistically significantly more likely to be divergent with respect to the validity of AHT and SBS."[88] Moreover, the Consensus Statement was endorsed by only a handful of U.S.-based medical groups and four foreign medical organizations.[89] Notably absent from the groups endorsing the Consensus Statement are, among others: the American Academy of Neurology, the American Academy of Ophthalmology, the American Society of Neuroradiology, the Academic Pediatric Association, the American Pediatric Society, the American College of Radiology, the College of American Pathologists, the North American Neuro-Ophthalmology Society, the Radiological Society of North America, and the British Medical Association. In reality, the Consensus Statement reflects the views of only a subset of physicians reflecting one side of a well-documented controversy, despite the Consensus Statement's assertion that "AHT is a scientifically non-

[88] Narang et al., Acceptance of Shaken Baby Syndrome, supra note 83, at 275.

[89] The Consensus Statement is supported by the Society for Pediatric Radiology (SPR), European Society of Paediatric Radiology (ESPR), American Society of Pediatric Neuroradiology (ASPNR), American Academy of Pediatrics (AAP), European Society of Neuroradiology (ESNR), American Professional Society on the Abuse of Children (APSAC), Swedish Paediatric Society, Norwegian Pediatric Association, Japanese Pediatric Society, Executive Committee of the American College of Radiology (ACR), Sociedad Latinoamericana de Radiología Pediátrica (SLARP), Société Francophone d'Imagerie Pédiatrique et Prénatale (SFIPP), American Association for Pediatric Ophthalmology and Strabismus (AAPOS), Asian and Oceanic Society for Paediatric Radiology (AOSPR), Australian & New Zealand Society for Paediatric Radiology (ANZSPR), Society of German-speaking Pediatric Radiologists (GPR), and the Pediatric Society of New Zealand.

controversial medical diagnosis broadly recognized and managed throughout the world."[90]

The substance of the Consensus Statement is also deeply flawed and has been criticized at length in various responses to it.[91] While the Consensus Statement was published in a reputable medical journal, it is evident that the piece was explicitly directed to the courts by advocating from the perspective of child abuse specialists and lawyers rather than objective scientists. The authors of the Consensus Statement explained that consensus statements are used to "educate" the courts about "what is accurate medical information and what is non-evidence."[92] However, the evidence and studies used to support the Consensus Statement are low-quality findings based on unsystematic clinical observations resting on subjective judgments, assumptions, and anecdotes. *See supra* Section II. The Consensus Statement's continued reliance on deeply flawed literature and its failure to acknowledge, much less refute, the controversy regarding SBS underscores the lack of reliability and objectivity in its positions.[93]

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[90] Consensus Statement, *supra* note 40, at 1049.

[91] *See, e.g.*, Findley et al., *Feigned Consensus*, *supra* note 41; Papetti et al., *supra* note 8.

[92] Consensus Statement, *supra* note 40, at 1049.

[93] The authors of the Consensus Statement warn that "[t]he denialists have tried to create a medical controversy where there is none." *Id.* at 1048. As discussed in Section III, there have been significant developments in the fields of radiology, biomechanics, ophthalmology, neurology, and forensic pathology that reveal the weaknesses in the previous literature supporting the SBS Hypothesis

Further, two of the main theories advanced in the Consensus Statement have been undermined since its publication. First, the Consensus Statement concluded that short distance falls are inconsistent with the triad constellation and AHT.[94] However, Atkinson et al. published an article in 2018 demonstrating that children who experience short distance falls have injuries that mimic AHT.[95] Atkinson et al.'s finding conflicts with the Consensus Statement's assertion that the triad constellation does not occur from short falls.

The Consensus Statement also rested on an assumption that retinal hemorrhages in infants were caused by repetitive acceleration/deceleration or abusive shaking.[96] Yet, the same year, one of the authors of the Consensus Statement, Dr. Cindy W. Christian, published a clinical report on child abuse and eye injuries acknowledging that a repetitive acceleration/ deceleration mechanism was only a potential "contributory factor"

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that underscore why it is considered highly controversial by the wider medical community. This controversy is unrelated to any supposed denial of the existence of child abuse or the harm it inflicts on society, as the authors of the Consensus Statement seem to imply.

[94] Consensus Statement, *supra* note 40, at 1052.

[95] *See* Atkinson et al., *supra* note 25, at 837 (2018).

[96] Consensus Statement, *supra* note 40, at 1059.

to retinal hemorrhages, and that retinal hemorrhages "have other etiologies especially in critically ill children."[97]

In any event, even the Consensus Statement reflects a shift in thinking about the SBS Hypothesis, echoing other public statements by proponents of the SBS Hypothesis. For example, the authors of the Consensus Statement admit that there *is* a consensus that (a) it is unknown whether shaking alone can produce the triad and (b) a diagnostic workup "must exclude diseases that mimic AHT" and only consider SBS/AHT when "accidental and disease processes cannot plausibly explain the etiology of the infant/child's injuries."[98] In sharp contrast to the old presumption of abuse any time an infant presented with the triad, the Consensus Statement established a burden of ruling out all non-abusive plausible explanations of a child's injuries before considering a diagnosis of abuse. In other words, the Consensus Statement admits that a diagnosis of abuse is inappropriate if a non-abusive cause (such as a disease or accident) is consistent with the documented findings and cannot be ruled out. Additionally, the Consensus Statement's authors appear to concede that the strongest conclusion that ever can be drawn is "whether an infant's injuries

[97] Cindy W. Christian et al., *The Eye Examination in the Evaluation of Child Abuse*, 142 Pediatrics 1, 4 (2018).

[98] Consensus Statement, *supra* note 40, at 1049.

were *most likely* caused by abuse" - a far cry from a medical diagnosis or a determination beyond a reasonable doubt.[99]

For all the reasons stated above, it cannot reasonably be disputed that the science does not support diagnoses of SBS and that the SBS Hypothesis is no longer generally accepted among the members of the relevant scientific communities that have studied the issue. At minimum, there is no "consensus" that the relevant scientific community supports the SBS Hypothesis. The assumptions underlying the SBS Hypothesis conflict with the main rule of evidenced-based medicine – that medical conclusions should be based on the best evidence that has been gathered, rather than outdated and subjective beliefs held by a narrow subset of the community – and therefore SBS "diagnoses" should have no place in court.

Conclusion

For the foregoing reasons, the Superior Court's order barring the admission of expert testimony regarding "Shaken Baby Syndrome/Abusive Head Trauma" should be affirmed.

[99] Consensus Statement, *supra* note 40, at 1059.

Respectfully Submitted,

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