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STATE OF MICHIGAN
IN THE SUPREME COURT
Appeal from the Michigan Court of Appeals
Judges Jonathan Tukel, Kathleen Jansen, and Thomas Cameron

PEOPLE OF THE STATE OF MICHIGAN,

Plaintiff-Appellee,

v.

MILTON LEE LEMONS,

Defendant-Appellant.

Supreme Court No. 163939

Court of Appeals No. 348277

Wayne Circuit Court No. 06-4818-FC

Amicus Brief of the American Academy of Pediatrics et al.

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INTEREST OF AMICUS

This amicus brief is submitted on behalf of the American Academy of Pediatrics, the Michigan Chapter of the American Academy of Pediatrics, the American Professional Society on the Abuse of Children, The Society for Pediatric Radiology, the American Association for Pediatric Ophthalmology & Strabismus, the Ray E. Helfer Society, and the National Children's Alliance (collectively, "Amici Medical Societies").[1]

Amici Medical Societies—representing tens of thousands of clinicians, treating physicians, pediatric neurologists, ophthalmologists, radiologists, and child-abuse prevention experts—have specific expertise in the research, diagnosis, treatment of abusive head trauma (AHT) injuries. As experts in the field, Amici Medical Societies and their members have a professional responsibility to provide courts with reliable scientific information. They are uniquely positioned to provide this Court with critical insight into the reliability of AHT theories from the perspective that matters most: the medical community.

* * *

The American Academy of Pediatrics is a national, not-for profit organization dedicated to improving child and adolescent health. The AAP is a non-partisan professional membership organization that represents over 67,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists nationwide. The Academy advances child and adolescent health through education, research, advocacy, and the provision of evidence-based policy and guidance, including on the prevention and accurate medical diagnosis of AHT.

The American Professional Society on the Abuse of Children (APSAC) is a nonprofit organization comprised of roughly 2,000 members from across disciplines focused on serving children and

[1] Neither party's counsel authored this amicus brief in whole or in part, or contributed money that was intended to fund the preparation or submission of the brief. See MCR 7.312(H)(4).

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families impacted by child maltreatment. It is a leading advocacy voice regarding issues of child abuse prevention, including AHT.

The Society for Pediatric Radiology (SPR) is a professional membership association with roughly 2,000 members dedicated to fostering excellence in pediatric health care through imaging and image-guided care. As discussed below, radiologists play an important role in accurately diagnosing AHT and other child abuse injuries.

The American Association for Pediatric Ophthalmology & Strabismus (AAPOS) is a professional membership association of roughly 2,000 members committed to identifying and promoting the highest quality medical and surgical eye care for all children. As discussed below, ophthalmologists are frequently consulted during the AHT differential diagnosis and provide vital information that clinicians rely on to make an accurate diagnosis.

The Ray E. Helfer Society is a society of over 600 physicians that provides leadership regarding the prevention, diagnosis, treatment, and research concerning child abuse and neglect. Its core mission includes promoting education and training in the medical aspect of child abuse and neglect, promoting high ethical standards for practice and research, and assisting in establishing guidelines for clinical practice.

The National Children's Alliance is a professional membership organization of advocates, partner agencies, communities, and researchers, committed to minimizing trauma for abused children and breaking the cycle of abuse.

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INTRODUCTION

Amici Medical Societies—representing the consensus views of clinicians, treating physicians, pediatric neurologists, ophthalmologists, radiologists, child-abuse prevention experts—are compelled to file this brief to clarify two interrelated misconceptions about abusive head trauma. The first is the false suggestion that the AHT diagnosis relies exclusively on the so-called "triad" of injuries. The second is the false impression that scientific advancements have undermined the foundation of AHT such that the diagnosis is no longer valid. These misconceptions, promoted from outside the mainstream medical community, have unfortunately taken hold in our legal system. Together, they form the basis for the (equally baseless) contention that there is controversy within the medical community regarding the general acceptance of AHT.

It is junk science, and the so-called "controversy" it has ginned up is a false one. The theories that have fueled the misconceptions above are founded on speculative, subjective beliefs of a small number of medical professionals who often lack expertise in pediatrics and lack appropriate grounding in scientific methods and procedures. They have been roundly rejected by the mainstream medical community.

It is the job of trial judges to keep this kind of pseudoscience from tainting the legal process, as the trial court rightly did here. Amici Medical Societies are deeply troubled that the Court of Appeals second-guessed that decision based on an uninformed assessment of the state of AHT science. See *People v Lemons*, unpublished per curiam opinion of the Court of Appeals, issued Nov 18, 2021 (Docket No. 348277), 2021 WL 5405754, *6 (stating that a "plethora of authority cited [by the defense experts] below make it clear that there is a genuine dispute regarding SBS and the diagnostic significance of the triad[.]"). By endorsing the reliability of these two pseudo-scientific concepts without scrutinizing the reliability of their evidence base, the Court of Appeals abdicated the gatekeeping function.

It is imperative that this Court not commit the same mistake. The promotion of unreliable medical science in the courtroom can have harmful effects, both in the legal system and the real world. It risks

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misleading or confusing non-scientist factfinders, which in turn undermines the credibility and reliability of legal judgments. More importantly, it poses an unacceptable risk to child safety. After all, AHT is not just a criminal law concern. It is a public health issue. The AHT diagnosis and medical literature are used by federal, state, and local public officials to administer child welfare programs in homes and in childcare settings. Further delegitimization of AHT through judicial pronouncements will disrupt these important efforts.

Amici Medical Societies acknowledge the legal system's special interest in ensuring that those accused of crimes are allowed an adequate defense and are convicted based on satisfactory proof. Understandably the law wants to get it right in these cases. But the medical community shares that same fundamental concern: misdiagnoses can have serious, even fatal, consequences for patients. The stakes are just as high in the clinic as they are in the courtroom. The AHT diagnosis is the result of decades of evidence-based studies repeatedly corroborated by researchers from across disciplines. It is for that reason that physicians confidently rely on the AHT science to make critical diagnosis decisions. Just as science must follow the evidence, so should the law. Promoting unreliable science disserves the justice system's worthy cause of ensuring reliable outcomes.

One more thing. Amici Medical Societies recognize that, no matter the outcome, this Court's decision will likely not put to rest this long-simmering legal debate over the appropriateness of fringe AHT theories in court proceedings. Looking forward, Amici Medical Societies urge this Court to consider another tool that courts already have at their disposal to provide reliable expert assistance for judges and juries. That is Michigan Rule of Evidence 706. This rule allows courts to appoint independent expert witnesses. Greater use of this procedure—in conjunction with the formation of a panel of highly qualified, impartial medical experts with clinical and research experience in child abuse medicine—can eliminate the harmful distorting effects of adversarial expert testimony in these cases. Amici Medical Societies respectfully request that this Court expressly endorse the use of MRE 706 and implement a framework for its broader use through its administrative and superintending powers.

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ARGUMENT

I. Courts should give special weight to the considered views of the relevant scientific community regarding a scientific theory's reliability under Rule 702.

This appeal concerns the use of certain scientific theories in the courtroom and whether they are sufficiently reliable under MRE 702. That rule requires the trial judge to confirm (among other things) that an expert witness' testimony "is the product of reliable principles and methods" and that the witness applied those principles and methods "reliably to the facts of the case." MRE 702. The goal of this gatekeeping task is "to make certain that an expert . . . employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field." *People v Kowalski*, 492 Mich 106, 120 (2012). Put differently, the criteria guiding the trial judge in evaluating the admissibility of an expert's testimony should be the same that the relevant scientific community uses to assess the reliability and validity of their peers' work.

In the field of science and medicine, these criteria may include whether the theory can, and has been, tested; whether it has been subjected to peer review and publication; whether the technique or studies used to support the theory have a known and acceptable error rate and control standards; and whether and to what extent the relevant scientific community accepts the theory or technique as valid and reliable. *Id*. at 131.

This last consideration, a reiteration of the earlier *Davis-Frye* "general acceptance" test, remains an important part of the gatekeeping analysis. See *Gilbert v DaimlerChrysler Corp*, 470 Mich 749, 782 (2004) ("[B]oth tests require courts to exclude junk science; *Daubert* simply allows courts to consider more than just 'general acceptance' in determining whether expert testimony must be excluded."). How a particular theory or methodology has been received by the mainstream scientific community is highly probative of its reliability. Members of the scientific community are trained to evaluate the design of studies, the statistical significance of findings, and the fit between those findings and the author's conclusions. Under *Daubert* and Rule 702, a trial judge

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should be highly skeptical of a theory widely deemed to be a "fringe" position by the group of individuals best positioned to assess the reliability of their peers' work. See *Daubert*, 509 US at 594 (" '[A] known technique which has been able to attract only minimal support within the community' may properly be viewed with skepticism." (quoting *United States v Downing,* 753 F2d 1224, 1238 (CA 3, 1985).

Unfortunately, it can be difficult for courts to accurately gauge the consensus of the relevant scientific community on a particular subject. They must rely on the evidence presented to them by the parties, which makes them susceptible to endorsing speculative theories unsupported by medical evidence and literature.

Consider an example. In *People v Ackley*, this Court suggested (in dicta) that there is a "prominent controversy within the medical community regarding the reliability of SBS/AHT diagnoses," 497 Mich 381, 391–392 (2015), citing as support a Wisconsin Court of Appeals decision that stated that "there has been a shift in mainstream medical opinion" and an "emergence of a legitimate and significant dispute within the medical community" regarding AHT, *State v Edmunds*, 746 NW2d 590, 598–599 (Wis Ct App, 2008). But *Edmunds*' statement was based on the testimony of the defendant's experts and was thus nothing more than a credibility assessment of their representations. *Id.* That proved particularly problematic because, apparently unbeknownst to *Edmunds* (and presumably this Court in *Ackley*), the theories advanced by those defense experts have been thoroughly discredited by the medical community.[2] *Ackley* and *Edmunds* highlight the potential pitfalls of relying solely on *ipse dixit* of a few select witnesses when

[2] For comprehensive discussion of this, see Narang et al, *A* Daubert *Analysis of Abusive Head Trauma/Shaken Baby Syndrome—Part II: An Examination of the Differential Diagnosis*, 13 Hous J Health L & Pol'y 203, 246–262 (2013); Moreno et al., *The Supreme Court Screws Up the Science: There Is No Abusive Head Trauma/Shaken Baby Syndrome "Scientific" Controversy*, 2013 Utah L Rev 1357, 1373–1388 (2013); Moreno et al., *Dissent into Confusion: The Supreme Court, Denialism, and the False "Scientific" Controversy Over Shaken Baby Syndrome*, 2013 Utah L Rev 153, 173 n 91 (2013); Narang et al., *Acceptance of Shaken Baby Syndrome/Abusive Head Trauma as Medical Diagnosis*, 177 J of Pediatrics 273 (2016).

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assessing the state of science from the scientific community's perspective.[3]

Far more probative are consensus and policy statements from recognized scientific bodies like Amici Medical Societies. The purpose of these professional organizations is to represent the professional interests of their members. Many (like Amici) have processes for gathering member input on a particular topic, synthesizing that input with the relevant scientific literature, and formulating policy statements, practice guidelines, or other educational materials that reflect the consensus position of their members. In the medical setting, consensus and policy statements can help courts assess the weight of the medical literature and differentiate between persuasive evidence-based medical research and unpersuasive published work (e.g., opinion articles, single case studies or discredited articles). In this way, they are valuable tools for distinguishing between evidence-based medical knowledge and speculative or professionally irresponsible opinions.[4]

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[3] The Court of Appeals here fell into the same trap when it stated that "[t]he extensive expert testimony offered in this case and plethora of authority cited below make it clear that there is a genuine dispute regarding SBS and the diagnostic significance of the triad." *Lemons*, 2021 WL 5405754, *6. As shown below, there is no "plethora of authority" recognized by the medical community as reliable that supports the proposition that "there is a genuine dispute regarding SBS and the diagnostic significance" of the so-called "triad."

[4] Just last Term, this Court relied on the "clear consensus" of the scientific community regarding brain development, as presented by a group of amici scientists and scholars, to support its holding that mandatory life-without-parole sentences for 18-year-olds was cruel and unusual punishment. *People v Parks*, 510 Mich __, 2022 WL 3008548, at *13–14 (2022), citing Brief of Amici Curiae Neuroscientists, Psychologists, and Criminal Justice Scholars at 1 n 2, 3, *People v Parks*, No. 162086 (Jan. 27, 2022) (presenting the "current scientific consensus regarding brain development" based on "data from studies conducted using the scientific method, which is subject to critical review by outside experts, including during the peer review process preceding publication in a scholarly journal"). The brief offers the same "clear consensus" of the scientific community regarding AHT.

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What follows reflects the consensus view of the medical community regarding abusive head trauma or AHT[5] and the false and misleading claims made about the diagnosis and its supporting literature. It draws from the two leading positions statements on AHT: the American Academy of Pediatrics' 2020 Policy Statement on Abusive Head Trauma in Infants and Children and the 2018 Consensus Statement on Abusive Head Trauma in Infants and Young Children. The latter is endorsed by the leading national and international professional societies in child abuse medicine, including Amici Medical Societies, the Executive Committee of the American College of Radiology, European Society of Paediatric Radiology, American Society of Pediatric Neuroradiology, European Society of Neuroradiology, Swedish Paediatric Society, Norwegian Pediatric Association, Japanese Pediatric Society, Sociedad Latino Americana de Radiología Pediátrica, Société Francophone d'imagerie Pédiatrique et Prénatale, Asian and Oceanic Society for Paediatric Radiology, and Australian and New Zealand Society for Paediatric Radiology. See Choudhary et al., *Consensus Statement on Abusive Head Trauma: Additional Endorsements*, 49 Pediatric Radiology 421 (2019).

II. The medical community does not recognize a genuine debate over the validity of abusive head trauma.

There is no valid medical controversy regarding the legitimacy of a diagnosis of abusive head trauma. It has been documented in over 40 years of medical research, which comprises over 1,000 peer-reviewed articles written by over 1,000 authors from across the world. Multiple medical societies have issued consensus statements regarding the validity of the diagnosis. Narang et al., *Policy Statement: Abusive Head*

[5] Amici use the term AHT to refer to the diagnosis of injuries "to the skull or intracranial contents of an infant or child younger than 5 years caused by inflicted blunt trauma, violent shaking, or both" Greeley, *Abusive Head Trauma: A Review of the Evidence Base*, 204 Am J Roentgenol 967 (2015). Contrary to some in the medico-legal community, the development of AHT as the preferred term is no indication of doubt in the diagnosis or the mechanism of shaking as a cause of injury. The AAP, the original proponent of the term AHT, continues to affirm the dangers of shaking infants and to embrace "shaken baby syndrome" as a valid subset of AHT.

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Trauma in Infants and Children, 145 Pediatrics (April 2020), From the American Academy of Pediatricians, p 1; Choudhary et al., *Consensus Statement on Abusive Head Trauma in Infants and Young Children,* 48 Pediatric Radiology 1048 (2018). Among those who regularly diagnose the cause of childhood head injuries, the diagnosis is almost universally accepted as valid. See Narang et al., *Acceptance of Shaken Baby Syndrome/Abusive Head Trauma as Medical Diagnosis*, 177 J of Pediatrics 273 (2016) (finding a 93% acceptance rate).

Notwithstanding the uniformity of the medical community's acceptance of the causes and mechanisms of AHT, a small cadre of expert witnesses have created the appearance of a controversy regarding AHT. This is a false controversy. It exists only in the courtroom, where advocates have been permitted to present unsubstantiated medical evidence that the medical community does not recognize as valid. Amici Medical Societies are troubled by this trend and urge this Court to follow the science and hold that such expert testimony is inadmissible under Rule 702 (as the trial court did below).

As discussed in Section II.A, contrary to the assertion of AHT denialists, AHT is *not* diagnosed based solely on the presence of the "triad" of AHT-related injuries. That assertion represents a myopic view of the comprehensive differential diagnosis process and fundamentally misunderstands how AHT is diagnosed in practice.

As discussed in Section II.B, and again contrary to the assertion of AHT denialists, subsequent research has *not* undermined the evidentiary foundation for AHT such that it is no longer a valid, reliable theory. The studies relied on by AHT denialists to support that assertion have been thoroughly discredited through the peer review process and are not considered reliable by the medical community.

Finally, as discussed in Section II.C., there are consequences to public health when the court system legitimizes fringe science through insufficiently rigorous *Daubert* analysis. Amici Medical Societies are genuinely concerned those consequences will come to fruition, at the expense of vulnerable infants and children, if this Court endorses the reliability of the AHT denialists' pseudoscience.

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A. The AHT diagnosis is a dynamic, complex differential process that considers all potential causes of a patient's injuries.

There is nothing to the suggestion that recent developments in AHT science have undermined the purported assumption that the presence of the "triad"—retinal hemorrhages, subdural hematomas, and brain swelling—are diagnostic for AHT. This assertion rests on unsound evidence and an inaccurate description of how the AHT diagnosis has always been made.

In practice, the AHT diagnosis is made like any other medical diagnosis: through the differential diagnosis methodology. Differential diagnosis is "a standard scientific technique of identifying the cause of a medical problem" by "consider[ing] all relevant potential causes of the symptoms and then eliminat[ing] alternative causes based on a physical examination, clinical tests, and a thorough case history." *Hardyman v Norfolk & W Ry Co,* 243 F3d 255, 260 (CA 6, 2001), quoting Federal Judicial Center, Reference Manual on Scientific Evidence 214 (1994); see also *Dengler v State Farm Mut Ins Co*, 135 Mich App 645, 649 (1984) (giving a similar definition).

AHT is on the differential (i.e., is a potential cause) when an infant or young child presents with "neurologic signs and symptoms such as irritability/lethargy, altered mental status, seizures, respiratory compromise and apnea, fractures, varying degrees of pattern marks or bruises in unusual locations, vomiting and poor feeding." Choudhary et al., *Consensus Statement,* 48 Pediatric Radiology at 1051–1052, citing Reece et al, *Inflicted Childhood Neurotrauma*, American Academy of Pediatrics (Elk Grove, Illinois, 2003) pp 49–64. If these are present, the clinician conducts a comprehensive medical evaluation, which includes a thorough physical examination, skeletal survey, laboratory studies, head and neck imaging, and a timely ophthalmology consultation.

This is a complex, dynamic process. The clinician must first consider a wide range of diagnostic criteria collected from an extensive, multi-disciplinary medical evaluation. During physical examination, clinicians must look for external bruises and tenderness, understanding that the absence of signs of external trauma to the head and neck is

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common. *Id.* at 1052, citing Gill et al., *Fatal Head Injury in Children Younger Than 2 Years in New York City and an Overview of the Shaken Baby Syndrome*, 133 Arch Pathol Lab Med 619 (2009). They must give special attention to bruising of the torso, ears, and neck, *id*, as well as fractures of the ribs, long bones, and shoulders, all of which are highly indicative of inflicted abuse. See Kemp et al., *Patterns of Skeletal Fractures in Child Abuse: Systematic Review*, 337 BMJ 859 (2008).

A timely eye exam is important. *Consensus Statement,* 48 Pediatric Radiology at 1053, citing Binenbaum et al., *The Natural History of Retinal Hemorrhage in Pediatric Head Trauma*, 20 J AAPOS 131 (2016). There are several ocular findings associated with AHT, the most common of which is retinal hemorrhages (bleeding inside the retina), which are found in approximately 85% of AHT cases. *Id.*, citing Kivlin et al., *Shaken Baby Syndrome*, 107 Ophthalmology 1246 (2000); Morad et al., *Correlation Between Retinal Abnormalities and Intracranial Abnormalities in the Shaken Baby Syndrome*, 134 Am J Ophthalmology 354 (2002). The clinician must recognize that retinal hemorrhages may be associated with several conditions, but a specific pattern of retinal hemorrhages—those that are too numerous to count, in multiple layers of the retina, and extending to the retinal periphery—are highly specific for AHT. *Id.*; see Bhardwaj et al., *A Systematic Review of the Diagnostic Accuracy of Ocular Signs in Pediatric Abusive Head Trauma*, 117 Ophthalmology 983 (2010). The same goes for "traumatic retinoschisis" (a splitting of the retinal layers), and "retinal folds" (an area of the retina where it is buckled up, projecting up out of the normal plane of the retina), both of which are more specific for AHT. *Id.*, citing Levin, *Retinal Hemorrhage in Abusive Head Trauma*, 126 Pediatrics 961 (2010); see also *Policy Statement: Abusive Head Trauma in Infants and Children*, 145 Pediatrics at 2 (stating that traumatic retinoschisis is "highly suggestive of abusive trauma").

Also vital to an accurate AHT diagnosis is a trained radiologist's interpretation of brain and neck imaging. *Consensus Statement,* 48 Pediatric Radiology at 1053. Intracranial bleeding is common in AHT and often presents as subdural hematoma. *Id.*, citing Kleinman, *Diagnostic Imaging of Child Abuse* (Cambridge University Press, Cambridge), pp 394–452; Bradford et al., *Serial Neuroimaging in*

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Infants with Abusive Head Trauma: Timing Abusive Injuries, 12 J Neurosurgery Pediatrics 110 (2013). Venous injury—specifically, disruption of bridging veins where they meet the superior sagittal sinus complex (the main vein between the cerebral hemispheres)—is considered the source of subdural hematomas and is strongly associated with AHT. *Id.*, citing Choudhary et al., *Venous Injury in Abusive Head Trauma*, 45 Pediatric Radiology 1803 (2015).

Finally, as with any differential diagnosis, a detailed clinical history is required. In the case of suspected AHT, the clinician should obtain history from the caretaker, understanding that inconsistency between the presenting history and the clinical findings bears strong statistical association with child maltreatment, and specifically AHT. Hymel et al., *Estimating the Relevance of Historical Red Flags in the Diagnosis of Abusive Head Trauma*, 218 J Pediatrics 178 (2020); Hettler et al., *Can the Initial History Predict Whether a Child with a Head Injury has been Abused?*, 111 Pediatrics 602 (2003). Regardless, the clinician should seek detailed developmental and past medical history of the patient, as well as relevant family history (including prior concerns for child maltreatment).

Throughout the differential process, the clinician gathers more information and "synthesiz[es] [it] with the known pathophysiologic processes of the human body, the evidence-based statistical information on the injuries, and the clinician's own experience in patient care." Narang, *A* Daubert *Analysis of Abusive Head Trauma/Shaken Baby Syndrome*, 11 Hous J Health L & Pol'y 505, 573 (2011). This is not a linear process. It involves both deductive and inferential reasoning. The clinician must consider multiple variables (clinical history, lab results, imaging findings) to deduce out those that are inconsistent with a diagnosis, while also looking for those variables that are more adductive (or confirming) of a diagnosis. It is only after "careful consideration of all historical, clinical and laboratory findings as well as radiologic investigations by the collaboration of a multidisciplinary team" that the

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clinician can come to an appropriate diagnostic conclusion, if one is warranted. *Consensus Statement,* 48 Pediatric Radiology at 1050.[6]

It is therefore overly simplistic, at best—and misleading, at worst—to suggest that clinicians reflexively diagnose AHT based solely on the presence of retinal hemorrhages, subdural hematomas, and brain swelling. (See Center for Forensic Integrity Amicus Brief ISO Application, p 2 (asserting that "physicians previously assumed that the presence of these findings pointed unerringly to shaking or other abuse").) As the European Society of Paediatric Radiology Child Abuse Task Force and The Society for Pediatric Radiology Child Abuse Committee have explained: physicians do not "diagnose the triad." Saunders et al., *Throwing the Baby Out with the Bath Water — Response to the Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU) Report on Traumatic Shaking*, 47 Pediatric Radiology 1386, 1389 (2017). Rather, the "triad" is merely a lawyer-created oversimplification of the complex differential diagnosis methodology that physicians employ. Treating physicians understand that a finding may have numerous other causes, or "mimics." It is the work of a skilled clinician to identify these mimics and gather more information that will help rule out potential causes. Singular focus on just one or even a few "mimics" misunderstands how a differential diagnosis is made.

B. AHT's evidence base has not been disturbed by unsubstantiated "fringe" theories that the medical community does not recognize as "good science."

Similarly unfounded are the suggestions that new scientific discoveries have discredited the science underlying the AHT diagnosis. The AHT literature base stretches back 60 years and features contributions (and endorsements) from across medical and scientific disciplines, including pediatricians, neuroradiologists, clinical and forensic pathologists, ophthalmologists, physiologists, and biomechanical engineers. See Albert et al., *Ensuring Appropriate Expert*

[6] That diagnostic conclusion, it is important to emphasize, is a *medical* conclusion, not a legal determination of the intent of the perpetrator or a "diagnosis of murder."

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Testimony for Cases Involving the "Shaken Baby", 308 JAMA 39, 39–40 (2012). It consists of high-quality peer-reviewed works, including:

- two medical treatises;
- at least 14 chapters in other medical treatises;
- over 700 peer-reviewed clinical medical articles published by over 1,000 medical authors from at least 28 countries;
- at least eight systematic reviews of the medical literature;
- at least 15 controlled trials;
- at least 50 comparative cohort studies or prospective case series; and
- numerous well-designed retrospective case series/reports comprising thousands of cases.

See Narang, *A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome*, 11 Hous J Health L & Pol'y 505, 538–540 (2011); see also *id.* at 596–627 (30-page bibliography of this peer-reviewed medical literature).

Of course, this is not to suggest that there are no unanswered questions or areas for further research. As with all scientific endeavors, work around AHT is not finished. But "not finished" does not mean "not enough." Historical reports, research data, and clinical experience have produced vast amounts of high quality, evidence-based information that allow physicians to diagnose AHT with a reasonable degree of medical certainty.

Nevertheless, a small group of defense witnesses and legal academics suggest that a "critical mass" of researchers now believe that the medical research underlying AHT is a "flawed science." Tuerkheimer, *The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts*, 87 Wash U L Rev 1, 1 (2009); see also Findley et al., *Shaken Baby Syndrome, Abusive Head Trauma, and Actual Innocence: Getting It Right*, 12 Hous J Health L & Pol'y 209 (2012).

To be clear, the medical community welcomes debate about the prevailing theories that physicians and scientists use to research, diagnose, and treat disease and injury. Like all of science, medical knowledge is neither stagnant nor monolithic; it develops and matures

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through continual questioning and critique. See Loevinger, *Standards of Proof in Science and Law,* 32 Jurimetrics J 323, 328 (1992) ("[S]cience is not so much a body of knowledge as an endless search for universal laws and a more inclusive coherent system of hypotheses."). That process—otherwise known as the scientific method—welcomes advancements in medical knowledge, so long as they are reached through a deliberate process designed to elevate valid theories and discard invalid ones. Physicians form new hypotheses, test those hypotheses through experimentation, and publish their findings for critical review and replication by members of the medical community. Hypotheses repeatedly corroborated by empirical testing become "theories" that the medical community generally accepts as valid—until new hypotheses come along to refine, and sometimes challenge, the prevailing view. Those that do not survive the crucible are rejected or ignored. This validation process is purposefully methodical to ensure that contributions to medical knowledge, which physicians rely on to make important decisions that affect their patients' health, are reliable.

To the extent the AHT denialists' theories have been subjected to the scientific process, they have been found by the medical community to be empirically unsubstantiated or plagued by fatal, unanswered flaws unearthed during the publication and review process. That includes the two main pillars that hold up the AHT denialists' assertion that recent scientific advancements have undermined the validity of the AHT diagnosis, which are (1) systematic reviews of the AHT literature base and (2) biomechanical studies. Neither have survived the crucible of the scientific method and have rightly been ignored by the relevant medical community.

1. The AHT denialists' "systematic reviews" of AHT literature are unreliable because they are methodologically flawed.

The primary basis for the notion that AHT is a flawed science are two systematic reviews of AHT literature that purport to show that the evidence base for AHT is unreliable. See Donohoe, *Evidence-Based Medicine and Shaken Baby Syndrome: Part I: Literature Review, 1966–1998 ("EBM & SBS Part I"),* 24 Am J Forensic Med & Pathology 239, 240–241 (2003) (concluding that "the commonly held opinion that the

finding of [subdural hemorrhage] and [retinal hemorrhage] in an infant was strong evidence [of] SBS [is] unsustainable, at least from the medical literature"); Lynøe et al., *Traumatic Shaking: The Role of the Triad in Medical Investigations of Suspected Traumatic Shaking,* 107 Acta Paediatrica 3 (2018) (concluding that "[t]here is insufficient scientific evidence on which to assess the diagnostic accuracy of the triad in identifying traumatic shaking").

The first of these is a three-page article written by Dr. Donohoe following a systematic review of 30 years' worth of AHT evidence using evidence-based medicine principles. But his work has been discredited by the medical community due to several serious methodological flaws. For starters, Dr. Donohoe used inexplicably narrow search terms to identify the universe of relevant literature. He searched only for the term "shaken baby syndrome," *EBM & SBS Part I*, 24 Am J Forensic Med & Pathology at 240, overlooking terms like "inflicted childhood neurotrauma," "childhood head injury," "craniocerebral trauma," and "inflicted traumatic brain injury." Consequently, he identified only 71 "relevant" articles and missed the vast majority of hundreds of articles on AHT, including two seminal works. In a letter to the editor published in the British Medical Journal, 106 physicians identified this and other methodological flaws in Dr. Donohoe's review, stating, "If the search had been appropriately more inclusive, the resulting conclusions would likely have been quite different." Robert Reece, *The Evidence Base for Shaken Baby Syndrome, Response to Editorial from 106 Doctors*, 328 BMJ 1316, 1316–1317 (2004).

On top of that, Dr. Donohoe's systematic review purported to evaluate the quality of AHT literature using a levels-of-evidence rating system. But his article failed to explain *how* he applied that system to the articles, making it impossible to independently replicate and verify his results or conclusions. What is apparent, however, is that Dr. Donohoe's conclusion that AHT lacked "high quality" evidence rested on the assumption that "high quality" meant randomized-controlled trials. See *EBM & SBS Part I*, 24 Am. J. Forensic Med. & Pathology at 240–241. Yet, it is well known that randomized trials are *not* an appropriate tool for evaluating a diagnosis like AHT, making Donohoe's assessment completely unreliable in the eyes of the medical community. See

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OCEBM Levels of Evidence Working Group, *The Oxford Levels of Evidence 2* (Oxford Centre for Evidence-Based Medicine) <https://www.cebm.ox.ac.uk/resources/levels-of-evidence/ocebm-levels-of-evidence> (accessed Feb 9, 2023).

The second systematic review of AHT literature using evidence-based principles, commissioned by the Swedish Agency for Health Technology Assessment and Assessment of Social Services in 2017, suffers from similar methodological flaws. The authors—none of whom had experience in forensic or child abuse pediatrics—chose to use only 30 publications, see Lynøe et al., *Traumatic Shaking,* 107 Acta Paediatrica at 7, again ignoring the vast bulk of relevant, quality medical literature on the topic (over 700 articles by this time). It arbitrarily excluded articles that did not involve "admitted or witnessed traumatic shaking or other trauma," *id.* at 6, even when the patient suffered "injuries at multiple sites, the combination of which would cause any practicing radiologist to suspect abuse," Saunders et al., *Throwing the Baby out with the Bath Water — Response to the Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU) Report on Traumatic Shaking*, 47 Pediatric Radiology 1386 (2017). In effect, the authors excluded information that would have been inconsistent with their conclusion—a hallmark of an unreliable study. Even more troubling, the authors of the Lynøe study were offered and refused external peer review by several leading professional medical societies (including The Society for Pediatric Radiology and the American Academy of Pediatrics)—yet another hallmark of unreliability. See Narang et al., *Lynøe et al. – #theRestoftheStory*, 106 Acta Paediatrica 1047, 1048–1049 (2017).

2. The AHT denialists' cherry-picked biomechanical studies are unreliable because they cannot replicate real world conditions.

AHT denialists also suggest that recent biomechanical engineering studies have undermined the core premise of AHT that shaking can produce enough forces to produce AHT-associated injuries. (See Center for Forensic Integrity Amicus Br. ISO Application, p 5, citing, among others, Duhaime et al, *The Shaken Baby Syndrome: A Clinical,*

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Pathological and Biomechanical Study, 66 J Neurosurgery 409, 414 (1987); Prange et al, *Anthropomorphic Simulations of Falls, Shakes, and Inflicted Impacts in Infants*, 99 J Neurosurgery 143, 149 (2003).)

The basis for this assertion is a 1987 study conducted by Dr. Duhaime and others, who used a doll model and measured peak accelerations from single episode shaking, with and without impact. Duhaime et al, *The Shaken Baby Syndrome: A Clinical, Pathological and Biomechanical Study*, 66 J Neurosurgery at 411–413. Using injury threshold criteria from monkey studies that were scaled down to approximate smaller infant skulls, the authors concluded that the whiplash forces do not provide enough force to account for the injuries typically associated with AHT and that blunt force trauma must be involved. *Id*. at 414.

But decades of subsequent peer review and attempts at replication have made clear that Duhaime's study is not reliable. In reality, there are "multiple differences—in tissue composition, brain and skull properties, and brain vulnerability—between adults and children," which have prompted the medical community "to interpret biomechanical studies that utilize scaling approaches with caution." Narang, et al., *A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome-Part II: An Examination of the Differential Diagnosis*, 13 Hous J Health L & Pol'y 203, 247 (2013). This includes the very Prange study cited in the Center for Forensic Integrity's amicus brief, which warns that "[t]hese injury projections should be interpreted with caution, because differences in species, age, material properties, geometry, and direction make scaling experimental angular acceleration and velocity measurements to infants problematic when based on differences in brain mass alone." *Anthropomorphic Simulations of Falls, Shakes, and Inflicted Impacts in Infants*, 99 J Neurosurgery at 149.

In fact, later studies that made just minimal adjustments to Duhaime's model produced forces that exceeded injury thresholds, thereby *refuting* Duhaime's hypothesis. See Cory et al., *Can Shaking Alone Cause Fatal Brain Injury? A Biomechanical Assessment of the Duhaime Shaken Baby Syndrome Model*, 43 Med Sci & Law 317, 317 (2003) (finding that altering the center of gravity produced forces that exceed injury thresholds in eight out of ten trials); Raghupathi et al.,

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Traumatic Axonal Injury is Exacerbated Following Repetitive Closed Head Injury in the Neonatal Pig, 21 J Neurotrauma 307 (2004) (finding more injury in neonatal pigs in double shake trial compared to single shake, indicating that immature brains are vulnerable to repeated, relatively mild, non-impact loading conditions); Wolfson et al., *Rigid-Body Modelling of Shaken Baby Syndrome*, 219 Proc Inst Mech Eng H 63 (2005) (producing results showing that concussion-levels of energy could be achieved through multiple-shake episodes).

These shortcomings are not unique to Duhaime's study. Biomechanical research in this area rests on experimental designs that are challenged to replicate the complex pathophysiology of the infant brain and spine. For example, many biomechanical studies rely on computer modeling that treats the human head as a single point. But "[w]ith 80 – 100 million neurons, layers of brain of different densities, and a non-spherical shape, the human brain is over simplified when reduced to a simple point or shape." Lindberg et al., *The "New Science" of Abusive Head Trauma*, 2 Int J Child Maltreat 1, 9 (2019). What's more, biomechanical studies use injury criteria that are based on "high-energy, single-impact studies." *Rigid-Body Modelling of Shaken Baby Syndrome*, 219 Proc Inst Mech Eng H at 63. But the forces generated in an episode of inflicted head trauma are complex: "Repetitive shaking can result in translational movement in 3 dimensions, as well as spinning and shear forces, simultaneously." *The "New Science" of Abusive Head Trauma*, 2 Int J Child Maltreat at 9.

All of this is to say that the rigors of the scientific process have shown that the utility of biomechanical studies in this area is sharply limited by its inability to faithfully replicate real world conditions. The scientific process is purposefully deliberate to guard against the kind of rush to judgment committed by those who claim that biomechanical studies have undermined the core assumptions of AHT. Through peer review and retesting, the scientific process has identified significant limitations to published biomechanical studies, including a lack of biofidelic integrity and failure to account for the accumulative effect of repeated forces. Because of these limitations, it is irresponsible to draw the kind of conclusions suggested by those who claim that shaking cannot

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produce enough force to produce AHT injuries. See *Consensus Statement,* 48 Pediatric Radiology at 1052.

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In short, there is no *genuine* dispute in the relevant medical community about the continued validity of AHT. Mainstream physicians with actual experience diagnosing and treating child abuse injuries almost universally agree the AHT diagnosis is based on sound scientific principles and methodology. See *Acceptance of Shaken Baby Syndrome/Abusive Head Trauma as Medical Diagnosis*, 177 J of Pediatrics at 273 (showing that AHT is recognized as a valid diagnosis by *93%* of academic pediatric neurosurgeons, pediatric neurologists, pediatric ophthalmologists, pediatric radiologist, pediatric critical care doctors, pediatric emergency medicine doctors, child abuse pediatricians and forensic pathologists at the 10 leading children's hospitals in the United States).[7] Those who cite biomechanical studies and the Donohoe and Lynøe systematic reviews as evidence of AHT's invalidity fail to mention the extensive, well-substantiated published critiques, which is a critical component to *Daubert*'s reliability inquiry. See *Ensuring Appropriate Expert Testimony for Cases Involving the "Shaken Baby"*, 308 JAMA at 39–40 (stating that AHT denialists "have a willingness to

[7] Some legal advocates have pointed to the AAP's 2009 Policy Statement, which states that "[f]ew pediatric diagnoses engender as much debate as AHT, in part because of the social and legal consequences of the diagnosis," as evidence of an acknowledged controversy within the medical community, see Findley et. al., *Feigned Consensus: Usurping the Law in Shaken Baby Syndrome/Abusive Head Trauma Prosecutions*, 2019 Wis L Rev 1211, 1217 (2019), quoting Christian, Block, & the Committee on Child Abuse and Neglect, *Abusive Head Trauma in Infants and Children,* 123 Pediatrics 1409, 1410 (2009). This is highly misleading, as the AAP's Position Statement goes on to explain that the "controversy" is not due to some shortcoming in the medical science behind AHT, but because of the nuanced nature of the differential diagnosis process and the "significant" "legal consequences of the diagnosis." *Abusive Head Trauma in Infants and Children,* 123 Pediatrics at 1410. In other words, advocates for accused individuals, who are not experts in child abuse medicine but are primarily concerned about the significant legal consequences of the diagnosis, are the cause of the controversy.

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disparage scientifically-grounded and accepted testimony" by "omit[ting] pertinent facts or knowledge"). Given the serious methodological flaws identified above, the biomechanical studies and the systematic literature reviews are an unreliable foundation upon which to assert the claim that AHT is no longer a valid diagnosis. The relevant scientific community has rejected these unreliable hypotheses; the trial court was correct to do so, as well.

C. Endorsing the reliability of AHT denialist theories will have costly and injurious public health consequences.

When deciding this case, it is important to keep in mind that AHT "is not just a crime—it is a public health issue." U.S. Department of Health and Human Services Centers for Disease Control and Prevention, *A Journalist's Guide to Shaken Baby Syndrome: A Preventable Tragedy*, p 2 <https://www.cdc.gov/violenceprevention/pdf/SBSMediaGuide.pdf> (accessed Feb 9, 2023). AHT is a leading cause of child abuse death in the United States and Michigan *Id.*; Michigan Child Death State Advisory Team, *Child Deaths in Michigan: A Report on Case Reviews Conducted from 2015 to 2019* (June 2022), p 89 (finding that AHT was the leading type of child abuse death in Michigan between 2015 and 2019 (43%)). For children who survive, nearly all suffer serious lifelong health consequences. *A Journalist's Guide*, at 2. According to one reputable estimate, the lifelong costs associated with roughly 4,000 AHT cases in 2010 was $13.5 *billion*. *Consensus Statement,* 48 Pediatric Radiology at 1050, citing Miller et al., *Lifetime Cost of Abusive Head Trauma at Ages 0–4, USA*, 19 Prev Sci 695 (2017).

Recognizing the moral, social, and financial imperatives to reducing and preventing child abuse, public- and private-sector institutions have developed important public health initiatives based on the premise that AHT is a valid diagnosis and health concern. For example, AHT training is a component of the licensing regime for childcare centers here in Michigan. See Mich Admin Code, R 400.8131(3) (requiring "all child care staff members and unsupervised volunteers who work directly with children shall be trained on prevention of shaken baby syndrome, abusive head trauma and child maltreatment").

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The Michigan Child Death State Advisory Team—which is mandated by state law to review and report on child mortality and make policy recommendations, see MCL 722.627b—relies on the AHT construct to accurately report the causes and contributors to childhood deaths in Michigan. See *Child Deaths in Michigan*, p 89 (finding that AHT was the leading type of child abuse identified by local CDR teams in Michigan between 2015 and 2019 (43%)).

Finally, the Child Abuse and Neglect Prevention Board, also known as the Children Trust Michigan, is a statutorily created body charged with funding and coordinating child abuse prevention programs and "encourage[ing] professional persons and groups to recognize and deal with prevention of child abuse and neglect." MCL 722.606(f). To carry out its mandate, it approves grants from the Children's Trust Fund using certain criteria, including whether a prevention program is "believed to be universally beneficial in curbing child abuse aimed at the general population." Mich Admin Code, R 722.751(1)(g); see also MCL 722.609, Mich Admin Code, R 722.755. And one of its special initiatives is the "Never Shake a Baby Campaign," which provides resources and administers grants to AHT programs. See Children Trust Michigan, *Special Initiatives* <https://www.michigan.gov/ctf/programs/initiatives> (accessed Feb 9, 2023).

These public health programs—which span licensing, research, and education efforts—are important complements to the work of child abuse physicians who diagnose and treat child abuse injuries. But these initiatives cannot succeed if there is confusion over whether AHT is a valid diagnosis. Cf. Mich Admin Code, R 722.751(1)(g). All this important work is at risk if this Court lends credence to the pseudoscientific theory that AHT is not valid. A judicial pronouncement that such testimony survives a *Daubert* challenge will give an aura of undeserved credibility to a fringe position that the AHT denialists have been unable to achieve in the relevant scientific community. That veneer of legitimacy will bleed into these other public health settings, many of which do not have the protections of MRE 702, increasing the likelihood that it will garner unwitting acceptance outside the courtroom. Amici Medical Societies are acutely concerned about the harm to public health if AHT becomes the latest casualty of fringe courtroom science.

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CONCLUSION AND RELIEF REQUESTED

Amici Medical Societies ask this Court not to give credence to a small group of legal and medical advocates who, for all their fervent claims in courtrooms and law reviews, have yet to put a dent in the decades-in-the-making scientific research behind AHT. This Court should hold that the trial court correctly excluded the defense experts' testimony that there has been a shift in scientific consensus regarding the validity of AHT and the so-called diagnostic power of the "triad."

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

I hereby certify that this document complies with the formatting rules in MCR 7.212(B). See MCR 7.312(A), (H)(3). I certify that this document contains 7,536 countable words. The document is set in Century Schoolbook, and the text is in at least 12-point type with 17-point line spacing and 12 points of spacing between paragraphs.

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