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CHILD ABUSE EVIDENCE: NEW PERSPECTIVES FROM LAW, MEDICINE, PSYCHOLOGY & STATISTICS

Anna Kirkland*, David Moran**, Angela K. Perone***

For many years, physicians have testified in criminal and family courts that they can reliably “diagnose” child abuse in infants and toddlers based on the child’s particular symptoms or injuries.¹ In other words, if a baby arrives at the hospital with symptoms X, Y, and Z, the physician testifies that the cause of those symptoms could only have been some form of intentionally inflicted abusive trauma, and the physician typically asserts this conclusion to a reasonable degree of medical certainty. If the finder of fact accepts the physician’s testimony, the consequences for the child’s parent or caregiver are severe: in a criminal case he or she may be sentenced to prison, or even to death,² and the family court may remove the child from the parents’ or guardian’s custody.

At its core, such testimony illustrates a classic example of a scientific hypothesis; that if conditions X, Y, and Z are true, then the cause must be intentionally inflicted abusive trauma. But only in the past few years have the relevant legal, medical, and scientific communities begun to seriously confront the question: How strong is the evidence supporting the hypothesis?^{2,3}

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1. See, e.g., Am. Acad. of Pediatrics, Comm. on Child Abuse and Neglect, *Shaken Baby Syndrome: Inflicted Cerebral Trauma*, 92 PEDIATRICS 872, 872 (1993) (defining Shaken Baby Syndrome as a serious form of child maltreatment); Brian Harding, R. Anthony Risdon & Henry F. Krous, *Shaken Baby Syndrome: Pathological Diagnosis Rests on the Combined Triad, Not on Individual Injuries*, 328 BMJ 720, 720–21 (2004); see generally Cindy W. Christian, Robert Block & Comm. on Child Abuse and Neglect, *Abusive Head Trauma in Infants and Children*, 123 PEDIATRICS 1409 (2009) (discussing ways that abuse—even beyond shaking—can cause head trauma in children); see generally Nancy D. Kellogg & Comm. on Child Abuse and Neglect, *Evaluation of Suspected Child Physical Abuse*, 119 PEDIATRICS 1233 (2007) (providing guidance to clinicians about evaluating suspected physical abuse in children).

2. See *Ex Parte Henderson*, 384 S.W.3d 833 (Tex. Crim. App. 2012) (affirming trial court decision overturning babysitter’s murder conviction and death sentence which were based largely on physicians’ testimony that baby’s injuries were consistent only with abusive head trauma and not with short fall, as babysitter claimed).

3. See Patrick D. Barnes & Michael Krasnokutsky, *Imaging of the Central Nervous System in Suspected or Alleged Nonaccidental Injury, Including the Mimics*, 18 TOPICS MAGNETIC RESONANCE IMAGING 53, 54–56 (2007) (discussing challenges in identifying a medical diagnosis based on a causative event (e.g. shaking) from imaging); Andrew P. Sirotiak, *Medical Disorders that Mimic Abusive Head Trauma*, in ABUSIVE HEAD TRAUMA IN INFANTS AND CHILDREN: A MEDICAL,

Each community asks essentially the same question a slightly different way. Physicians ask whether the diagnosis of child abuse meets the standards of evidence-based medicine.⁴ Scientists, particularly biomechanists, ask whether the hypothesis is consistent with the laws of nature.⁵ And lawyers ask whether the testimony is sufficiently reliable under the standards governing the admissibility of scientific and technical evidence.⁶ But, at their core, the questions raised are the same: can we reliably diagnose intentional child abuse from a particular set of symptoms and injuries alone?

In recent years, scholars and practitioners have raised more and more challenges to the most well-known such hypothesis, Shaken Baby Syndrome (SBS), now known as Abusive Head Trauma (AHT), a term which also includes intentionally-inflicted head injuries produced by mechanisms other than shaking. Critics have, for example, questioned whether shaking really generates the type of forces capable of causing the supposedly hallmark injuries without causing other injuries such as neck damage,⁷ and they have recounted the history of the SBS/AHT diagnosis in ways that

LEGAL, AND FORENSIC REFERENCE 191–226 (G.W. Med. Publ'g 2006); see Gilbert Vezina, *Assessment of the Nature and Age of Subdural Collections in Nonaccidental Head Injury with CT and MRI*, 39 PEDIATRIC RADIOLOGY 586, 590 (2009) (noting radiology and clinical challenges in evaluating head injury in suspected child abuse cases); see generally Patrick D. Barnes, *Imaging of Nonaccidental Injury and the Mimics: Issues and Controversies in the Era of Evidence-Based Medicine*, 49 RADIOLOGIC CLINICS N. AM. 205 (2011) (discussing critiques to the triad by evidence-based medical and legal principles); see generally C.C. Meltzer et al., *Guidelines for the Ethical Use of Neuroimages in Medical Testimony: Report of a Multidisciplinary Consensus Conference*, 35 AM. J. NEURORADIOLOGY 632 (2014) (presenting guidelines to consider amidst growing concern over potential misuse of neuroradiologic imaging data in legal cases).

4. See, e.g., Mark Donahoe, *Evidence-Based Medicine and Shaken Baby Syndrome*, 24 AM. J. FORENSIC MED. & PATHOLOGY 239 (2003) (concluding that the studies cited in support of Shaken Baby Syndrome diagnosis do not meet standards of evidence-based medicine).

5. See, e.g., A.K. Ommaya et al., *Biomechanics and Neuropathology of Adult and Paediatric Head Injury*, 16 BRIT. J. NEUROSURGERY 220 (2002) (concluding, from review of biomechanical literature, that accidental short falls can produce far greater forces than abusive shaking and that it was improbable that shaking could produce retinal hemorrhaging).

6. See, e.g., Sandeep Narang, *A Daubert Analysis of Abusive Head Trauma/Shaken Baby Syndrome*, 11 HOUS. J. HEALTH L. & POL'Y 505 (2011) (arguing that testimony diagnosing Abusive Head Trauma or Shaken Baby Syndrome satisfies test of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993)).

7. See Ann-Christine Duhaime et al., *The Shaken Baby Syndrome: A Clinical, Pathological, and Biomechanical Study*, 66 J. NEUROSURGERY 409 (1987) (concluding that severe head injuries commonly associated with shaking injuries require impact to occur and that shaking alone unlikely caused the 13 child fatalities reviewed after suspicions of “shaken baby syndrome”); see Faris A. Bandak, *Shaken Baby Syndrome: A Biomechanics Analysis of Injury Mechanisms*, 151 FORENSIC SCI. INT'L 71, 76–79 (2005) (finding that an infant head subjected to the levels of rotational velocity and acceleration required in the Shaken Baby Syndrome literature would result in forces on the infant neck that far exceed the cervical spine's limits).

emphasize its conjectural nature.⁸ The SBS/AHT diagnosis is singular in its powerful deployment in a criminal justice context because it draws on the authority of medicine to combine a theory of criminal intent, a mechanism, and a culprit into a neat diagnostic package. Criticism of SBS/AHT has consistently been interdisciplinary, therefore, because understanding why it is problematic requires assessing its scientific and evidence-based shortcomings but also placing it in the context of contemporary police interrogation practices, psychological research on bias and motivated reasoning, the emotional resonance of an injured or dead child, and the professional cultures of child abuse pediatricians and social workers. In addition to a growing body of medical, scientific, and legal literature questioning the SBS/AHT hypothesis, the last few years have seen a major investigative series in one of the nation's leading newspapers,⁹ at least one book for general readers,¹⁰ and an award-winning documentary film,¹¹ all casting doubt on the diagnosis.

Especially in the case of SBS/AHT, the arguments skeptics have raised in both the scholarly and popular press appear to be turning the tide in the courts. More and more American courts have overturned convictions of parents and caregivers convicted on the hypothesis,¹² and many courts and judges, including three justices of the U.S. Supreme Court, have either expressed skepticism of the SBS hypothesis or at least recognized that there is a legitimate debate about its validity.¹³ Most recently, the President's Council of

8. See 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, 223–44, 273–90 (2012) (tracing the history and flaws of SBS/AHT).

9. See *Shaken Science*, WASH. POST (Mar. 20, 2015), <https://www.washingtonpost.com/graphics/investigations/shaken-baby-syndrome/> (multipart investigation into the science supporting SBS/AHT).

10. DEBORAH TUERKHEIMER, *FLAWED CONVICTIONS: "SHAKEN BABY SYNDROME" AND THE INERTIA OF INJUSTICE* (2015).

11. *THE SYNDROME* (Reset Films 2015).

12. See *Shaken Science*, *supra* note 9 (noting that U.S. courts had overturned at least sixteen SBS convictions between 2001 and 2015, including three in 2014 and early 2015 and finding "about 200 [SBS] cases in 47 states that ended when charges were dropped or dismissed, defendants were found not guilty or convictions were overturned").

13. See, e.g., *Cavazos v. Smith*, 565 U.S. 1, 10 (2011) (Ginsburg, J., dissenting) ("Doubt has increased in the medical community 'over whether infants can be fatally injured through shaking alone.'") (quoting *State v. Edmunds*, 746 N.W.2d 590, 596 (Wis. App. 2008)); *Commonwealth v. Millien*, 2015 WL 10944994, at *14 (Mass. June 3, 2016) (observing "there is a vigorous debate on this subject" and reversal is warranted because "the jury only heard one side of this debate"); *People v. Ackley*, 870 N.W.2d 858 (Mich. 2015) (noting "prominent controversy within the medical community" over validity of SBS hypothesis) (citing *Edmunds*, 746 N.W.2d at 391–92); *Del Prete v. Thompson*, 10 F. Supp. 3d 907, 957 n.10 (N.D. Ill. 2014) ("[R]ecent developments in this area . . . arguably suggest[] that a claim of shaken baby syndrome is more an article of faith than a proposition of science."). The highest court

Advisors on Science and Technology (PCAST) issued a report in September 2016 condemning the lack of scientific evidence supporting several forensic disciplines and added, “PCAST notes that there are issues related to the scientific validity of other types of forensic evidence that are beyond the scope of this report but require urgent attention—including notably arson science and abusive head trauma commonly referred to as ‘Shaken Baby Syndrome.’”¹⁴ At the end of 2016, the SBU—the Swedish Agency for Health Technology Assessment and Assessment of Social Services—completed a comprehensive review of the SBS/AHT literature and concluded that there is “insufficient evidence on which to assess the diagnostic accuracy of the triad in identifying traumatic shaking” and that the evidence that did exist was of “very low quality.”¹⁵

In order to shed more light on this growing controversy, the University of Michigan brought together a group of distinguished scientists, lawyers, physicians, and statisticians who have written, researched, and litigated various aspects of the issue for a conference, “Child Abuse Evidence: New Perspectives from Law, Medicine, Psychology and Statistics.” This event responded to Michigan Statistics professor Ben Hansen’s experience of being wrongly accused of child abuse by a child abuse pediatrician at our own Mott Children’s Hospital in February 2013.¹⁶ Professor Hansen experienced a false accusation, police interrogation and investigation,

of at least one nation has similarly cast doubt on the hypothesis. *M.M. v. Prosecutor-General, Sweden Supreme Court 2014-10-16 B 3438-12* (Swed.) at 10 (concluding that “the scientific evidence for the diagnosis of violent shaking has turned out to be uncertain”).

14. PRESIDENT’S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY, FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE-COMPARISON METHODS 23 n.15 (2016).

15. SBU ASSESSMENT REPORT 255E/2016: TRAUMATIC SHAKING THE ROLE OF THE TRIAD IN MEDICAL INVESTIGATIONS OF SUSPECTED TRAUMATIC SHAKING 5 (2016). <http://www.sbu.se/en/publications/sbu-assesses/traumatic-shaking—the-role-of-the-triad-in-medical-investigations-of-suspected-traumatic-shaking/>.

16. The following statement appeared in the conference program, signed by Professors Hansen and Kirkland (citations have been added):

“One might speculate that diaper changing, a time often associated with frustration because children typically cry then, may also trigger a caretaker’s tendency to fracture a child’s extremities.”

“[The Mott child abuse pediatrician] went on to state that this was a forced injury. . . probably while changing a diaper.” “Changing a diaper was her theory.”

“I know you’re guilty. I see it in your face. I see it in your eyes. I see it in your hair.”

These statements trace the arc of our family’s experience that led us to organizing this event. The first appears in a widely used child abuse textbook. Wilbur Smith, *Imaging in Child Abuse*, in *THE BATTERED CHILD* 231 (Mary Edna Helfer, Ruth S. Kempe & Richard D. Krugman, eds., 5th ed. 1997). The second comes from a report of the Ann Arbor police department, describing what detectives were told when they arrived at the university hospital to investigate our daughter’s broken leg. We had brought

and social work evaluation first hand in many roles simultaneously: as a wrongfully accused father and profiled citizen, but also as a scholar of causal inference, logic, and methodology of science.¹⁷ Co-author Anna Kirkland, married to Professor Hansen, also experienced wrongful accusations both as a mother and as a scholar of law, discrimination, and the interplay between scientific evidence and public policy.¹⁸ Professors Hansen and Kirkland were horrified to see how sloppy reasoning, poor evidence, confirmation bias, incorrect thinking about statistics, and racial and gender-based assumptions drove accusations in their experience, and concluded that as faculty members they could be in a unique position to help improve knowledge and practices so that other families would not suffer the same treatment. The conference occurred at the University of Michigan Law School on November 6, 2015, and students and faculty along with hundreds of members of the public turned out to observe the proceedings and question the speakers.¹⁹

her to the hospital after a sequence of examinations at her pediatrician's office could not pinpoint the source of her discomfort or the swelling in her leg.

An investigation was appropriate. It was incorrect to direct investigators to a single speculative explanation and incorrect to facilitate the kind of police interviews that followed.

The third quote is from the detective who interviewed Ben, who is African-American. Moments later, that detective shouted at Anna that she must have hit her baby on the changing table, isn't that how it happened? These interviews took place in our daughter's hospital room and in an adjacent room, with our other child, then five, present for the "bad cop" routine. The child protection literature relies too much on confessions extracted by manipulating worried parents.

Consistent with our view that the injury must have occurred in an accident, this investigation ended without charges. Along the way we encountered problems relating to diversity, a current focus of self-scrutiny at Michigan, in two ways: more should be done to limit the role of cognitive biases—which are likely to harm already disfavored groups—in shaping investigations; and the field of child protection stands to gain from multidisciplinary, international perspectives such as those that we, along with Abigail Stewart and David Moran, have assembled today. Thank you for joining us.

17. *Ben Hansen*, UNIV. MICH., COLLEGE OF LITERATURE, SCI., & ARTS, DEP'T OF STATISTICS, <https://lsa.umich.edu/stats/people/faculty/bbh.html> (last visited Jan. 14, 2017).

18. *Anna Kirkland*, UNIV. MICH., COLLEGE OF LITERATURE, SCI., & ARTS, DEP'T OF WOMEN'S STUD., <http://lsa.umich.edu/content/michigan-lsa/women/en/people/core-faculty/akirklan.html> (last visited Jan. 14, 2017).

19. The conference was generously funded by the Office of the Dean at the University of Michigan, College of Literature Science and the Arts, the University of Michigan Law School, and the ADVANCE Project. The Institute for Research on Women and Gender (IRWG), the Institute for Social Research (ISR), the Population Studies Center, the departments of Sociology, Statistics, and Psychology, the Program in Science, Technology, and Society (STS), the Center for Bioethics and Social Sciences in Medicine (CBSSM), the department of Health Management and Policy in the School of Public Health, and the Ford School of Public Policy were co-sponsors of the event.

The speakers included two physicians who have studied child abuse diagnoses: DR. PETER ASPELIN, a professor of medical radiology at the Karolinska Institutet in Stockholm, Sweden, and DR. PATRICK D. BARNES, the chief of pediatric neuroradiology at the Lucile Packard Children's Hospital and Stanford University Medical School; two attorneys who have litigated them from opposite sides: LEIGH BISHOP, the chief of the Child Fatality Unit of the Queens County District Attorney's Office in New York City, and KATHERINE H. JUDSON, the SBS/AHT Litigation Fellow at the Wisconsin Innocence Project; three psychologists: DR. RICHARD A. LEO, a professor of law and psychology at the University of San Francisco, who has written extensively on false confessions; KEITH MADDOX and SAM SOMMERS, both associate professors of psychology at Tufts University, who have researched cognitive bias issues in criminal law; and two statisticians: STEPHEN E. FIENBERG, a professor of statistics at Carnegie Mellon University, and his PhD student, MARIA CUELLAR, both of whom have explored issues of circularity and statistical association in child abuse studies. The speakers' full scholarly biographies are available on the Symposium website.²⁰

We were privileged to be the organizers of the conference along with Ben Hansen and Abigail Stewart, and we are pleased now to present the edited transcript of the day's proceedings in this Journal. We hope the conference and this transcript will contribute to the important and ongoing debate. There are many intriguing research questions remaining in this area for a wide range of scholars. It is clear that fundamental medical and scientific research questions remain unanswered and contested, and we must not only gather more evidence but also continually assess the strength of that evidence. Child abuse—its causes, manifestations, and effective prevention—remains an underfunded medical research area with low prestige; a fuller understanding of its complexities would require a kind of multidisciplinary, socially conscious, and careful mobilization of many professionals that is very difficult to arrange generally, and nearly impossible given the power struggles and discord of the current SBS/AHT debates. Indeed, studying the challenges of child abuse evidence through a sociological lens on the competing professions involved and their struggles for legitimacy, status, and power would be an original and much-needed approach. There is much we do not yet know about how child abuse diagnoses and accusations work within the criminal justice sphere, in social services interventions, and within effected families.

20. See *Speakers' Biographies*, UNIV. MICH. C. LITERATURE, SCI., AND THE ARTS, <http://sites.lsa.umich.edu/npcae/speakers/>.

Perspectives from legal scholars, medical anthropologists and sociologists, psychologists, social work researchers, demographers, and scholars of race, gender, and culture would enrich our understandings of how these diagnoses change our worlds.

Legal reforms and legislative actions could greatly improve our abilities to understand child abuse evidence more clearly and help us avoid the injustices of false accusations, wrongful convictions and imprisonment, and disrupted healthy families. First, legal reforms could include more rigorous scrutiny among trial judges of at least two of the four *Daubert* factors for assessing admissibility of expert testimony, including the existence of known or potential rate of error and general acceptance in the relevant scientific community.²¹ As statistical experts Stephen E. Fienberg and Maria Cuellar pointed out in this symposium, scientific evidence presented in American courts is often plagued by measurement error and misinterpretation of the data. Cuellar specifically outlined such problems in a paper often cited by experts testifying for the prosecution in SBS/AHT cases that claims very few young children die from short falls—thus suggesting that if the parent or caregiver claimed that the child died from a short fall, abuse is a much more likely hypothesis.²² Furthermore, legal scholars suggest that while courts have generally accepted AHT as a valid medical diagnosis (without really applying the *Daubert* factors), they have offered little guidance regarding what constitutes the “general acceptance” and “relevant scientific community” in a field where many disciplines offer insight.²³

Second, reforms should address the presence and potential for bias in investigations of abuse. Given that CTs and MRIs cannot definitively determine the presence of that abuse,²⁴ courts should also equally consider evidence from a competent and thorough

21. See *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 594 (1993) (outlining the factors as follows: (1) whether a theory or technique could be tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) whether there was a known or potential rate of error; and (4) whether there was general acceptance in the relevant scientific community).

22. See generally David L. Chadwick, Gina Bertocci, Edward Castillo, Lori Frasier, Elisabeth Guenther, Karen Hansen, Bruce Herman & Henry F. Krous, *Annual Risk of Death from Short Falls Among Young Children: Less than 1 in 1 Million*, 121 PEDIATRICS 1213 (2008) (describing results from a systematic review that found only six possible fall-related fatalities of young children in a population of 2.5 million young children over a five-year period).

23. Narang, *supra* note 6, at 580–82 (2011).

24. See Barnes & Krasnokutsky, *supra* note 3, at 54–56 (discussing challenges in identifying a medical diagnosis based on a causative event (e.g. shaking) from imaging); Sirotnak, *supra* note 3, at 191–226; see Vezina, *supra* note 3, 590 (noting radiology and clinical challenges in evaluating head injury in suspected child abuse cases); see generally Barnes, *supra* note 3 (discussing critiques to the triad by evidence-based medical and legal principles).

child protection investigation²⁵ that fully incorporates statements from the persons caring for the child at the time of the injury. However, investigators often carry their own implicit biases and may have a tendency to engage in “tunnel vision” when considering evidence.²⁶ As pointed out by legal expert Katherine Judson at this conference, greater transparency through an investigation can help ensure that bias in misinterpretation of the evidence does not result in inaccurate conclusions. Encouraging investigators to invest in more robust documentation, including recording interviews, may help reduce such bias.

While legal reforms such as these can help, it is even more important that the scientific community weigh in. As PCAST recently recognized, the need for rigorous and impartial scientific review of the validity of SBS/AHT and other child abuse diagnoses is “urgent.”²⁷ Based on such diagnoses, parents and caregivers are being sent to prison today, and families are being torn apart today. We hope, therefore, that this publication of the conference proceedings, along with all of the other recent developments, will soon lead to a comprehensive review of the science by PCAST or National Academy of Sciences.²⁸

Reform and scientific review are vital for preventing misdiagnoses and ensuring the civil rights, health, and justice of families facing accusations of SBS/AHT and other forms of child abuse.

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25. See Barnes & Krasnokutsky, *supra* note 3, at 54–56 (discussing challenges in identifying a medical diagnosis based on a causative event (e.g. shaking) from imaging); see Vezina, *supra* note 3, at 590 (2009) (noting radiology and clinical challenges in evaluating head injury in suspected child abuse cases).

26. See Keith A. Findley & Michael S. Scott, *The Multiple Dimensions of Tunnel Vision in Criminal Cases*, 2006 WIS. L. REV. 291, 292 (2006) (describing the tendency for “tunnel vision” and to “select and filter evidence” that will support a preliminary impression of wrongdoing) (citing Dianne L. Martin, *Lessons About Justice from the “Laboratory” of Wrongful convictions: Tunnel Vision, the Construction of Guilt and Informer Evidence*, 70 UMKC L. REV. 847, 848 (2002)).

27. See *supra* note 16 and accompanying text.

28. See Findley et al., *supra* note 8, at 309 (advocating for independent review of the validity and basis for AHT diagnosis by the National Academy of Sciences).