2021 PA Super 30

IN THE INTEREST OF: M.R., A MINOR	:	IN THE SUPERIOR COURT OF PENNSYLVANIA
APPEAL OF: PHILADELPHIA DEPARTMENT OF HUMAN SERVICES ("DHS")	:	No. 1400 EDA 2020

Appeal from the Order Entered June 26, 2020
In the Court of Common Pleas of Philadelphia County Juvenile Division at No(s): CP-51-DP-0000952-2019

IN THE INTEREST OF: M.R., A MINOR	:	IN THE SUPERIOR COURT OF PENNSYLVANIA
APPEAL OF: M.R., CHILD	:	No. 1401 EDA 2020

Appeal from the Order Entered June 26, 2020
In the Court of Common Pleas of Philadelphia County Juvenile Division at No(s): CP-51-DP-0000952-2019

IN THE INTEREST OF: J.R., A MINOR	:	IN THE SUPERIOR COURT OF PENNSYLVANIA
APPEAL OF: PHILADELPHIA DEPARTMENT OF HUMAN SERVICES ("DHS")	:	No. 1402 EDA 2020

Appeal from the Order Entered June 26, 2020
In the Court of Common Pleas of Philadelphia County Juvenile Division at No(s): CP-51-DP-0000953-2019

IN THE INTEREST OF: J.R., A MINOR	:	IN THE SUPERIOR COURT OF PENNSYLVANIA
	:	

APPEAL OF: J.R., CHILD : : : : : : No. 1403 EDA 2020

Appeal from the Order Entered June 26, 2020
In the Court of Common Pleas of Philadelphia County Juvenile Division at
No(s): CP-51-DP-0000953-2019

BEFORE: BENDER, P.J.E., OLSON, J., and KING, J.

OPINION BY BENDER, P.J.E.: **FILED: MARCH 1, 2021**

The Philadelphia Department of Human Services ("DHS") appeals from the June 26, 2020 orders adjudicating dependent M.R., a child, and his twin sister, J.R., a child (collectively, "Children"), but not finding child abuse as to B.R. ("Mother") and R.R. ("Father") (collectively, "Parents"). Children's guardians *ad litem* ("GAL") also appeal from those same orders. At issue in these appeals is whether the trial court abused its discretion by admitting the testimony of Parents' expert witness, Marvin Miller, M.D., who opined that metabolic bone disease of infancy ("MBDI") caused Children's multiple fractures, instead of abuse.[1] Alternatively, DHS and GAL contend that, even if Dr. Miller's testimony was admissible, the trial court abused its discretion in declining to find child abuse, given the overwhelming medical evidence presented at the adjudicatory hearing that Children's injuries were caused by abuse. After careful review, we conclude that the trial court improperly

[1] Another name for MBDI is Temporary Brittle Bone Disease ("TBBD"). We use both names interchangeably herein.

admitted Dr. Miller's testimony and, therefore, we reverse its orders refusing to make a finding of child abuse against Parents in each child's case.

The trial court summarized the procedural history and facts of this matter as follows:

> Children were born on March 7, 2019. [DHS] first became aware of … Children and their family … when it received a [Child Protective Services ("CPS")] report indicating that M.R. was diagnosed with multiple unexplained fractures. Subsequently, an additional CPS report was received when J.R. was subsequently diagnosed with several unexplained fractures. As a result of the CPS reports, an [Order of Protective Custody ("OPC")] was obtained for both [C]hildren. A shelter care hearing was held on June 7, 2019[,] at which time … Children were placed into kinship care. This [c]ourt subsequently held a bifurcated adjudicatory and child abuse hearing on February 7, 2020[,] and June 26, 2020.
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> At the February 7, 2020 adjudicatory hearing, Dr. Maria Henry testified that she is currently employed at [Children's Hospital of Philadelphia ("CHOP")] and serves as an attending physician on the [Suspected Child Abuse and Neglect ("SCAN")] team, which evaluates children for child abuse. All counsel stipulated to Dr. Henry's expertise in general pediatrics and pediatric child abuse. Dr. Henry indicated that [the] Child Protection Team was consulted on June 3, 2019[,] due to concerns of non-accidental trauma as the cause of … Children's injuries. She stated that M.R. was initially admitted to the hospital on June 2, 2019[,] with scrotal swelling. While at the hospital, he was diagnosed [with] a fractured forearm and multiple rib fractures after doctors observed "fussiness[.]" As a result of [M.R.'s] multiple fractures, the genetics team was consulted to determine whether there was a genetic cause for the injuries. Dr. Henry testified that the genetics team found no underlying genetic conditions that would cause the injuries after performing a skeletal survey. Additionally, Dr. Henry stated that the endocrinologist team was also consulted to determine whether an underlying bone disorder was present. After examining M.R.'s [v]itamin D levels and [x]-rays, the team

> found no "rickets" or other underlying bone conditions.[2] Additionally, she stated that the reported fussiness was likely "paradoxical fussiness[,"] which can be indicative of a child's pain due to an injury such as rib fractures.[] Dr. Henry further testified that as … Children are twins, J.R. was also examined for injuries. As a result, J.R. was diagnosed with multiple rib fractures. Dr. Henry testified that she underwent the same testing as M.R.[,] with similar results of no underlying genetic or bone disorders. Nemours[Alfred I. DuPont] Hospital [for Children ("Nemours")] also performed a skeletal survey after [P]arents sought a second medical opinion, which yielded the same results as the CHOP skeletal survey.
>
> Dr. Henry also took a family history during her investigation. She stated that Mother confirmed … Children were unable to roll. Additionally, she testified that Mother stated M.R. was "fussier than normal" the day prior to his hospitalization. She also reported that [P]arents denied any recent accidental trauma to … Children. Additionally, Dr. Henry noted that the family history did not contain any known bone diseases. Dr. Henry also stated that … [P]arents had … large family support, with numerous family members occasionally watching … Children.
>
> Dr. Henry concluded that the injuries to Children were the result of non-accidental trauma. Because all of the medical testing performed at CHOP determined … Children had no underlying genetic or bone disorders, she indicated that the injuries were caused by trauma. With respect to the nature of the injuries, Dr. Henry stated the amount of force necessary to cause the rib

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[2] Dr. Henry explained that rickets is most commonly caused by vitamin D deficiency and that "when children are not receiving sufficient vitamin D, that can have an effect on the bones, and … there are typical[ly] radiographic signs on the … bones when children's bones are being affected by low vitamin D levels." N.T., 2/7/20, at 59. ***See also*** N.T., 6/26/20, at 91 (another CHOP doctor, Dr. Sabah Servaes, testifying that "rickets is a systemic disorder where there is a disorder and there's vitamin D deficiency in infants that could be due to multiple causes, and it results in a disorganized laying down of new bone and causes some very characteristic findings on x-ray[s], for example, we see [it in] very typical locations. And it's an endocrine disorder or can be considered an endocrine disorder. It's a metabolic bone disease disorder, and it can be treated and corrected.").

> fractures is rarely seen in accidental injuries. As a result, Dr. Henry found that … Children's fractures are most consistent with abuse to a degree of medical certainty.
>
> Dr. Cara Skraban also testified that she is currently employed at CHOP and serves as an attending physician in clinical genetics. All counsel stipulated to Dr. Skraban's expertise in general pediatrics and clinical genetics. Dr. Skraban testified that she performed a consultation for … Children when they were hospitalized in June 2019. As a part of the consultation, she examined … Children's radiographs and performed genetic testing. She testified that the radiographs appeared to be normal, which indicated no physical signs of an underlying genetic condition or bone demineralization. Additionally, Dr. Skraban testified that … Children's genetic testing resulted in no clinically significant markers for osteogenesis imperfecta.[3] Dr. Skraban found that … Children did not have an underlying bone disease, osteogenesis imperfecta[,] or other medical condition that would have caused their injuries. Dr. Skraban further testified regarding her review of the report generated by the clinical geneticist at Nemours who was consulted for … Children, Dr. [Michael] Bober. She stated that Dr. Bober confirmed CHOP's findings after the subsequent skeletal survey and additional testing.

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[3] Dr. Skraban described that:

> [O]steogenesis imperfecta is a genetic condition. It's actually a family of genetic conditions in which the bones themselves aren't properly formed in regards to the internal structure.
>
> So, osteogenesis imperfecta is due to abnormalities in the collagen of the individual. And, so, we think of collagen in our skin and in other areas, but it's also really important in our bones to make sure that our bones are strong and prevent against fractures.
>
> And, so, the common cause of osteogenesis imperfecta is due to a difference in the gene, that … makes that collagen. And, so, what you end up having is an abnormal collagen in the bones that makes them weak and makes them fracture very easily.

N.T., 2/7/20, at 140-41.

> Anna Schuettge also testified that she is currently employed as a Nurse Practitioner at Karabots [Pediatric Care Center], a primary care practice connected with CHOP. Ms. Schuettge testified that she was part of … Children's treating group of doctors prior to June 2, 2019.[4] Ms. Schuettge stated that she administered an Edinburg test to Mother on May 6, 2019, in order to screen for signs of depression. She indicated that Mother's score was 12, which resulted in suggestion of a safety plan and therapy for Mother. She also stated that Mother had reported a history of depression. Additionally, Ms. Schuett[ge] testified that she did not observe any physical injuries on … Children during their medical appointments.
>
> Jennie Niamonitos testified that she was the DHS investigative social worker assigned to Children's case. She stated that … [P]arents would not speak with her regarding how the injuries occurred. Additionally, she further testified that Parents would not provide any possible kinship resources.
>
> Mother was also called to testify. She stated that she was the primary caretaker of … [C]hildren, but family members frequently visited. Mother acknowledged seeking a second opinion with Nemours and a third opinion with Dr. Miller. She indicated that she sent Dr. Miller … Children's medical files.
>
> Prior to the June 26, 2020 adjudicatory hearing, a motion was made by DHS and [GAL] to exclude the expert testimony of Dr. … Miller. After considering the briefs submitted by the parties, this [c]ourt allowed [D]r. Miller to testify.
>
> Dr. Miller testified that he is employed at Dayton[] Children's Hospital and serves as the Director of Medical Genetics. Additionally, he testified that he is a professor of pediatrics and OB/GYN at Wright State University Boonshoft School of Medicine. For the purposes of the adjudicatory hearing, Dr. Miller was certified as an expert in pediatric medical genetics[and] bone health. Dr. Miller testified that he prepared a report for … Children's case after being contacted by [P]arents. He testified that he reviewed … Children's medical records, medical history, Mother's delivery and pregnancy history, and diagnostic imaging studies in writing his report. He concluded that … [C]hildren had

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[4] Ms. Schuettge testified that Parents had brought Children into Karabots multiple times prior to June 2, 2019, for issues mainly related to Children's being "gassy" and fussy. ***See*** N.T., 2/7/20, at 166-67, 171-73, 190.

> [MBDI], which was a plausible alternative explanation for the fractures. He explained that he believed MBDI occurs primarily in the first three months after birth because the fetus could not move well in the womb. He testified that[,] during this time, the baby is more susceptible to fractures because of his [or her] weaker bones. After the baby turns three months of age, the bones increase in strength. Dr. Miller testified that this disorder was part of a study published in [t]he Journal of Pediatric Endocrinology and Metabolism, a peer[-]reviewed journal.[5]
>
> In forming this conclusion, Dr. Miller testified that there is no specific genetic testing for MBDI. Instead, he stated that diagnosis depends on several other tests and tools such as … Children's and Mother's medical history. Specifically, Dr. Miller stated that he looks at several factors to determine whether MBDI is a likely diagnosis; however, all factors do not need to be present.
>
> Dr. Miller testified that several factors were present in … Children's case[,] including the following: [m]aternal [v]itamin D deficiency, specific medications taken by … Mother, … Children's low birth weight[,] and their status as twins. Specifically, Dr. Miller testified that Mother had a high likelihood of a [v]itamin D deficiency during her pregnancy because … Children are twins and she had previously had a gastric bypass surgery. Additionally, Dr. Miller stated … Children's prescribed Zantac could have led to an increased risk of fractures, as indicated by medical studies. Because of the presence of several factors for MBDI, Dr. Miller concluded that … Children suffered from MBDI and the condition was a plausible explanation for their injuries.[6]

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[5] ***See*** Miller M., Stolfi A., Ayoub D. *Findings of metabolic bone disease in infants with unexplained fractures in contested child abuse investigations: a case series of 75 infants.* J. PEDIATR. ENDCRINOL. METAB. 2019; 32:1103-20. Hereinafter, we cite to this article as "Dr. Miller's Journal Article."

[6] In Dr. Miller's expert report, he stated that he also reviewed Children's x-rays and the report of radiologist, Dr. David Ayoub, with whom Dr. Miller regularly consults, and they both noted findings of MBDI in Children, including the following:

> [J.R.]

> Dr. Sabah Servaes testified as a rebuttal witness for DHS. Dr. Servaes testified that she is employed by CHOP as an attending pediatric radiologist. Additionally, she testified that she is employed by the University of Pennsylvania Medical School as a professor in radiology. For the purposes of the adjudicatory hearing, Dr. Servaes was qualified as an expert in pediatric radiology. Dr. Servaes testified that she wrote an article to the editors of [t]he Journal of Pediatric Endocrinology and Metabolism criticizing Dr. Miller's publication. Specifically, she opined both that the methodology was flawed and [that] … MBDI [is not] a recognized disorder [by child abuse teams in the field in which she works].[2] Additionally, she testified that Children's normal [v]itamin D levels at the time of their hospitalization would disprove Dr. Miller's explanation for the injuries. Dr. Servaes also stated that [the] Child Protection Team declined to review Mother's prenatal records. Dr. Servaes concluded that … Children did not suffer from [MBDI] based upon the testing and [x]-rays she reviewed.
>
> [2] The Journal of Pediatric Endocrinology and Metabolism did not retract Dr. Miller's study as a result.
>
> Based on the foregoing testimony, this [c]ourt adjudicated … Children dependent based upon [42 Pa.C.S. §] 6302(1). Additionally, the trial court denied a finding [of] child abuse as to [P]arents or aggravated circumstances. On July 24, 2020, DHS

> a. Widened ribs consistent with rachitic rosary
> b. Subperiosteal new bone formation
> c. Clubbed radius
> d. Picture framing of the vertebrae
> e. Growth arrest line
> f. Osteopenia
>
> [M.R.]
>
> a. Osteopenia
> b. Picture framing of the vertebrae

Parents' Exhibit 3 (Report of Marvin E. Miller, M.D.) at 3. ***See also*** N.T., 6/26/20, at 64 (Dr. Miller's testifying that he regularly consults Dr. Ayoub, and that he discussed the x-ray findings with Dr. Ayoub in preparing his expert report in this case).

> filed a timely [n]otice of [a]ppeal along with a [concise s]tatement of [e]rrors….[3]
>
> [3] On July 13, 2020, … DHS filed a timely Motion to Reconsider Admission of Parents' Expert Witness and the Court's Lack of Finding Child Abuse.[7]
>
> ***
>
> Subsequently, on July 24, 2020, … [GAL] filed a timely [n]otice of [a]ppeal along with a [concise s]tatement of [e]rrors….

Trial Court Opinion ("TCO"), 8/24/20, at 2-8 (internal citations omitted).

On appeal, DHS and GAL raise virtually identical issues for our review.

DHS asks:

> 1. Did the trial court abuse its discretion by admitting the testimony of Dr. … Miller, who opined that … Children's injuries were caused by [MBDI] and not abuse, where the medical establishment has rejected MBDI as a fringe theory that does not exist outside the courtroom?
>
> 2. Did the trial court abuse its discretion by declining to find that Parents were perpetrators of child abuse where … Children sustained numerous, unexplained fractures that were highly indicative of child abuse, testing ruled out possible medical or genetic causes, and … Children sustained no new injuries after being removed from Parents' care; and where the sole evidence of a possible non-abusive cause was Dr. Miller's novel and un-testable theory that … Children may have MBDI, but he admitted he would never find abuse unless the parent confessed, plus objective record facts such as … Children's lab results directly refuted his claims?

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[7] Our review of the docket indicates that the trial court did not rule on DHS's motion for reconsideration. Therefore, it is deemed denied. ***See*** Pa.R.C.P. 1930.2(b) ("A party aggrieved by the decision of the court may file a motion for reconsideration in accordance with Pa.R.A.P 1701(b)(3). If the court does not grant the motion for reconsideration within the time permitted, the time for filing a notice of appeal will run as if the motion for reconsideration had never been presented to the court."); Pa.R.A.P. 1701(b)(3) (explaining the requirements for the trial court's granting reconsideration).

DHS's Brief at 4. GAL poses the following questions for our review:

> 1. Pa.R.E[.] 702(c) states that a witness who is qualified as an expert may testify ***if*** "the expert's methodology is generally accepted in the relevant field." Consequently, did the trial court err by denying DHS's and … [GAL's] Motion To Preclude the Testimony of Marvin Miller, M.D., where Dr. Miller's methodology regarding his theory of [MBDI]/[TBBD]is not generally accepted in the medical field, and, in fact, is widely rejected?
>
> 2. DHS must present clear and convincing evidence that Parents intentionally, knowingly[,] or recklessly caused bodily injury to a child through any recent act or failure to act. And, 23 Pa.C.S. § 6381(d), provides that *prima facie* evidence of child abuse exists if a child has suffered abuse of such a nature as would ordinarily not be sustained or exist except by reason of the acts or omissions of the parent. Consequently, did the trial court err by failing to find child abuse by Parents where (1) DHS presented clear and convincing evidence through the testimony of three CHOP experts in pediatrics, genetics[,] and radiology that … [C]hildren's multiple broken ribs and arm were the result of child abuse, (2) Parents were the only responsible caregivers for J.R. and M.R., and (3) Parents failed to rebut the evidence beyond Dr. Miller's widely rejected theories?

GAL's Brief at 5-6 (emphasis in original).

Issue 1

First, DHS and GAL challenge whether the trial court abused its discretion by admitting the testimony of Dr. Miller, who opined that MBDI caused Children's fractures, not abuse. They argue that Dr. Miller's testimony is inadmissible because his methodology is not generally accepted in the medical field, as required by Pennsylvania Rule of Evidence 702 and ***Frye v. United States***, 293 F. 1013 (D.C. Cir. 1923).

Frye and Rule 702

At the outset, we note that, "[w]hen reviewing a trial court's grant or denial of a ***Frye*** motion, an abuse of discretion standard applies." ***Walsh Estate of Walsh v. BASF Corp***., 234 A.3d 446, 456 (Pa. 2020) (citation omitted). "An abuse of discretion may not be found merely because an appellate court might have reached a different conclusion, but requires a result of manifest unreasonableness, or partiality, prejudice, bias, or ill-will, or such lack of support so as to be clearly erroneous." ***Grady v. Frito-Lay, Inc.***, 839 A.2d 1038, 1046 (Pa. 2003) (citation omitted).

Our Supreme Court has recently examined Rule 702 and ***Frye***, explaining:

> Rule 702, entitled "Testimony by experts," which controls the admissibility of expert testimony on scientific knowledge, states:
>
> > A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge is beyond that possessed by the average layperson; (b) the expert's scientific knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; and (c) **the expert's methodology is generally accepted in the relevant field.**
>
> Pa.R.E. 702 (emphasis added).
>
> The requirement that the expert's methodology be generally accepted is commonly referred to as the ***Frye*** test. First announced in ***Frye***…, 293 F. at 1013, it was adopted by this Court in Pennsylvania in ***[Commonwealth v.] Topa***[, 369 A.2d 1277 (Pa. 1977)]. In ***Grady***…, … 839 A.2d [at] 1047…, we clarified that the ***Frye*** rule "applies to an expert's method, not his conclusions." As artfully stated by former Chief Justice Cappy,
>
> > The ***Frye*** standard is limited to an inquiry into whether the **methodologies** by which the scientist has reached her conclusions have been generally accepted in the scientific

> community…. It restricts the scientific evidence which may be admitted as it ensures that the proffered evidence results from scientific research which has been conducted in a fashion that is generally recognized as being sound, and it is not the fanciful creations of a renegade researcher. Yet, such a standard is not senselessly restrictive for it allows a scientist to testify as to new conclusions which have emerged during the course of properly conducted research.

Blum [v. Merrell Dow Pharma., Inc.], 764 A.2d [1,] 9 [(Pa. 2000)] (Cappy, C.J., dissenting) (emphasis in original). The proponent of the admission of expert scientific evidence bears the burden of establishing all of the elements supporting its admission, including the general acceptance of the methodology employed in the relevant scientific community. ***Grady***, 839 A.2d at 1045; ***Betz [v. Pneumo Abex LLC]***, 44 A.3d [27,] 54 [(Pa. 2012)]. While the methodologies employed by the expert must be generally accepted, the conclusions reached from those applications need not also be generally accepted. ***Trach v. Fellin***, 817 A.2d 1102, 1112 (Pa. Super. 2003) (*en banc*).

The Court in ***Grady*** made clear that whether a methodology is generally accepted in the relevant scientific community is a determination that has to be made based on the testimony of the scientists in that community, not upon any scientific expertise of judges.

> One of the primary reasons we embraced the ***Frye*** test in ***Topa*** was its assurance that judges would be guided by scientists when assessing the reliability of a scientific method. ***See Topa***, 369 A.2d at 1281 (quoting ***United States v. Addison***, 498 F.2d 741, 744 (D.C. Cir. 1974)). Given the ever-increasing complexity of scientific advances, this assurance is at least as compelling today as it was in 1977, when we decided that case. We believe now, as we did then, that requiring judges to pay deference to the conclusions of those who are in the best position to evaluate the merits of scientific theory and technique when ruling on the admissibility of scientific proof, as the ***Frye*** rule requires, is the better way of insuring that only reliable expert scientific evidence is admitted at trial.

Grady, 839 A.2d at 1044-45; ***see also id.*** at 1045 ("This does not mean, however, that the proponents must prove that the scientific community has also generally accepted the expert's

> conclusion. … This, in our view, is the sensible approach, for it imposes appropriate restrictions on the admission of scientific evidence, without stifling creativity and innovative thought.").
>
> ***
>
> A careful review of our prior ***Frye*** decisions makes clear that it is the trial court's proper function to ensure that the expert has applied a generally accepted scientific methodology to reach his or her scientific conclusions. **To fulfill this function, the trial court must be guided by scientists in the relevant field, including the experts retained by the parties in the case and any other evidence of general acceptance presented by the parties (e.g., textbooks).** Conversely, trial courts may not question the merits of the expert's scientific theories, techniques[,] or conclusions, and it is no part of the trial court's function to assess whether it considers those theories, techniques[,] and/or conclusions to be accurate or reliable based upon the available facts and data. As is plainly set forth in Rule 702(c), the trial court's role is strictly limited to determining whether "the expert's methodology is generally accepted in the relevant field." Pa.R.E. 702(c). The trial court may consider only whether the expert applied methodologies generally accepted in the relevant field, and may not go further to attempt to determine whether it agrees with the expert's application of those methodologies or whether the expert's conclusions have sufficient factual support. Those questions are for the jury to decide.

Walsh, 234 A.3d at 456-57, 458 (footnotes omitted; some emphasis added).

Furthermore, this Court has observed that:

> "Scientific" methodology is based on
>
> > generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry. … Stated differently, the scientific method is a method of research in which a problem is identified, relevant data are gathered, a hypothesis is formulated from these data, and the hypothesis is empirically tested. Within the meaning of the definition of the scientific method, empirical means provable or verifiable by experience or experiment. Key aspects of the scientific method include the ability to test or verify a scientific experiment by a parallel experiment or other

> standard of comparison (control) and to replicate the experiment to expose or reduce error.

Commonwealth v. Hopkins, 231 A.3d 855, 871 (Pa. Super. 2020) (quoting ***Trach***, 817 A.2d at 1113). "Courts accept a variety of sources as evidence that the expert's methodology is generally accepted, including judicial opinions, scientific publications, studies, and statistics, expert testimony, or a combination of the above." ***Id.*** at 872 (citations omitted).

Motions to Preclude and Testimony at the Hearing

To address the admissibility of Dr. Miller's testimony, we must delve deeper into the record. Initially, we look to the motions to preclude Dr. Miller's testimony that DHS and GAL filed below. In GAL's motion, it stated:

> 1. Dr. Miller is not qualified to testify under [Rule] 702 because his theory of [TBBD], also known as [MBDI], is not generally accepted in the relevant field. To the contrary, it is widely rejected and practitioners consider it "grossly irresponsible" to rely on Dr. Miller's theories.
>
> 2. In the textbook, *Diagnostic Imaging of Child Abuse*, edited by Paul Kleinman, MD, FAAP,[8] Chapter 13 addresses Dr. Miller's [TBBD], and concludes:
>
> > What has occurred with the theory of TBBD is that it has taken on a Frankenstein-like existence in which, despite no data of reasonable quality supporting its existence, and compelling data undermining its proposed pathophysicologic mechanisms, it regenerates in an evermore tortured form. The primary explanation for the continued interest in the theory is the interface of the judicial system in child abuse pediatrics. Without judicial proceedings, TBBD would not have survived this long. There

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[8] "FAAP" stands for Fellow of the American Academy of Pediatrics. GAL attached relevant portions of Chapter 13 to its motion as Exhibit A.

> is no medical or scientific debate regarding the existence of TBBD; the debate exists for the sake of the court room [*sic*].

3. On January 16, 2020, the Society for Pediatric Radiology Child Abuse Committee wrote a criticism[, attached as Exhibit B,] of Dr. Miller's theories:

> This letter is written on behalf of the Society for Pediatric Radiology (SPR) Child Abuse Committee. We write collectively to respond to the recent article by Miller, Stolfi[,] and Ayoub to correct the record. Miller *et al*. opine that "infants who present with multiple unexplained fractures … are often diagnosed as victims of child abuse[,"] and that in these cases, unexplained fractures should instead be attributed to [MBDI].
>
> There is no legitimate medical evidence to support these authors' conclusion. Their methods of evaluation deviate from standard practice guidelines and care, which are based on decades of evidence and supported by multidisciplinary consensus. Numerous published reports in well-regarded academic and public scientific journals have convincingly established that these authors and the authors they cite have engaged in a pattern of flawed and misleading scholarship that is demonstrably inconsistent with the relevant and voluminous evidence-based medical literature. This recent publication simply recycles flawed and inaccurate claims by Miller, Stolfi[,] and Ayoub: calling normal bones "rickets"; characterizing classical metaphyseal lesions as "rickets"; labeling healing bone fractures as "Looser zones"; and calling normal cupping of the distal ulna "rickets[.]"[9] … In this report, Miller and his

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[9] To put this critique into context, Dr. Miller's article states that "[t]he radiographic abnormalities of MBDI … are those of healing rickets. Rickets is a mineralization deficiency that can be related to inadequate vitamin D, calcium and/or phosphate during pregnancy and early infancy." ***See*** Dr. Miller's Journal Article at 1111. The article claims that these radiographic abnormalities often go unappreciated or are dismissed by the reading radiologist because, "while pediatric radiologists are familiar with the radiographic findings of active rickets in which metaphyseal fraying is a hallmark, they are unfamiliar with the radiographic findings of healing rickets/MBDI in which metaphyseal fraying is absent." ***Id.*** at 1112.

> coauthors run afoul of professional norms and standards of scientific inquiry. If their false and misleading arguments are repeated in court and communicated to the public, they could create a grave public health risk. Parents and caregivers told that — regardless of the evidence — they could be falsely accused of child abuse will avoid seeking necessary or even lifesaving medical attention for their infants and children.

4. Moreover, *Diagnostic Imaging of Child Abuse* explained that Dr. Miller's "hypothesis" has "very notable shortcomings," including:

> a. "poor level of evidence,"
>
> b. "profound amount of bias" in the studies because the infants "are haphazardly selected["] and are "referred primarily by attorneys or parents accused of abusing them,"
>
> c. there is little to no follow-up,
>
> d. the investigators "have an explicit motivation for a particular finding," and
>
> e. two fatal flaws — the outcome is subjective and the investigator knows the outcome in advance.[1]

> [1] In ***State v. Duncan***, No. CRC94-04801, *slip op.* (Fl. Circ. Ct. 6th Dist. Dec. 11, 2018), a Florida court concluded in a similar case that neither Dr. Miller nor his counterpart, Dr. Ayoub[,] satisfied the ***Frye*** test. Rather, the court held that both Drs. Ayoub and Miller admitted that "their theory has not been generally accepted in the scientific community." Dr. Ayoub further testified that "the medical community largely relies on Dr. Kleinman's textbook *Diagnostic Imaging of Child Abuse*,["] and that Dr. Kleinman is an authority in this field. Further, both Drs. Miller and Ayoub "testify exclusively for the defense.["] The evidence also shows that neither is objective in their analysis of the evidence finding no case of child abuse where there is not a confession or witness to the abuse. (***State v. Duncan*** is attached as Exhibit C.)

5. *Diagnostic Imaging of Child Abuse* concludes: "The authors of the case reports find the proposition of TBBD unreasonable. Miller sees TBBD in many infants with fractures despite other more

> reasonable explanations, and finds no circumstances in which TBBD could be shown *not* to be present."
>
> 6. As DHS articulated, courts across the county routinely reject testimony from Dr. Miller because his theory is a hypothesis that is "not supported by conventional medical science." ***In re Jett***, No. 302732, 2011 Mich. App. LEXIS 1708 (Mich. App. Ct. Sept. 29, 2011) (finding trial court erroneously admitted Dr. Miller's testimony). ***See also In re JD & GD***, No. 231322, 2002 Mich. App. LEXIS 3878 (Mich. App. Ct. June 7, 2002[)] ("Dr. Miller conceded that TBBD was not recognized in the [International Classification of Diseases, 9th Edition] and that most child abuse experts do not believe such a disease exists."); ***State v. Swain***, No. 01CA2591, 2002 Ohio App. LEXIS 327 (Ohio App. Ct. Jan. 23, 2002) (Dr. Miller conceded he was "the only person in the United States writing about the topic as a recognizable disease…"); ***In the Interest of A.A.T.***, No. 04-16-344 CV, 2016 Tex. App. LEXIS 13714 (Tex. App. Ct. Dec. 28, 2016) (finding trial court properly excluded testimony from Dr. Miller regarding [MBDI] or [TBBD]).
>
> [7.] Indeed, as recently as 2019, Dr. Miller acknowledged that "there was some dispute within his practice about him continuing to do testimony or consulting" related to [MBDI]. ***Lowery v. State***, 2019 Tenn. Crim. App. LEXIS 359 (Tenn. Crim. App. June 24, 2019[).]

GAL's Motion to Preclude Parents' Expert Witness Dr. Marvin Miller, 6/2/20, at 1-4 (some internal citations omitted; emphasis in original; some emphasis omitted). In addition, DHS's motion similarly discussed other jurisdictions' criticisms of Dr. Miller's theory, and noted the "lack of reliability and acceptance of [MBDI/TBBD] as a legitimate medical diagnosis in children by the medical community." DHS's Motion to Preclude Parents' Expert Witness Dr. Marvin Miller, 5/20/20, at 7.[10]

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[10] We deem the arguments raised below by GAL and DHS sufficient to preserve this issue for our review. Thus, we disagree with Parents' assertions that "DHS and [GAL] failed to offer the trial court any analysis challenging the underlying

In response, Parents claimed below that the issue is whether the scientific community generally accepts the methodology used by Dr. Miller, ***not*** whether that community generally accepts his conclusions. With respect to Dr. Miller's methodology, Parents contended that:

> The scientific methodology utilized by Dr. Miller is supported by the American Academy of Pediatricians [("AAP")]. In 2014, the AAP released a policy statement declaring[,] "Preexisting medical conditions and bone disease may make a child's bones more vulnerable to fractures. These entities should be considered in the differential diagnosis of childhood fractures." In this policy statement, the AAP specifically identified preterm birth, [v]itamin D [d]eficiency, rickets, and demineralization from disuse as contributing factors to bone fragility.[11] One of the methods utilized by Dr. Miller is based on the widely accepted Utah Paradigm, a model for understanding bone strength and risk factors for metabolic bone disease. The Utah Paradigm is also used and accepted by the [AAP.[12]]
>
> Dr. Miller's methodology and conclusions have been published in well-respected medical and scientific journals. Most recently, in July[] 2019, Dr. Miller's work was published in the Journal of Pediatric Endocrinology and Metabolism. (***See*** Exhibit A). This article was subject to blinded peer review by experts in pediatric endocrinology who are well versed in metabolic bone disorders. Peer-reviewed research is in fact the gold standard for general acceptance in the medical and/or scientific community. In 2018, doctors from Sweden published a peer[-]reviewed article entitled "Metabolic Bone Disease Risk Factors Strongly Contributing to

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data and methodology utilized by Dr. Miller in his research." Mother's Brief at 17; ***see also*** Father's Brief at 14 (same).

[11] Parents did not attach this policy statement as an exhibit to their response, or provide a citation to it.

[12] Again, Parents do not attach as an exhibit, or provide a citation to, evidence of the AAP's using and accepting the Utah Paradigm.

> Long Bone and Rib Fractures During Early Infancy."[13] This peer[-]reviewed research identified similar risk factors that Dr. Miller identified as risk factors for [MBDI] such as "maternal obesity; mother of African, Asian or Latina descent; multiple births[;] infants born small for gestational age; and infant diagnosis of [v]itamin D deficiency." (***See*** Exhibit B). Furthermore, as part of Dr. Miller's methodology in evaluating for [MBDI], one of the factors that he considers is the use of antacids by a mother during pregnancy as well as whether or not the subject infant has been placed on an antacid. In July 2019, the [AAP] published a study by Drs. Malchodi & Wagner, entitled "Early Acid Suppression Therapy Exposure and Fracture in Young Children." (***See*** Exhibit C). Among the various conclusions drawn by the authors is that infant use of antacids is associated with childhood fracture hazard so that the use of antacids in infants should be weighed carefully against possible fracture. The [AAP] is not a fringe organization espousing wild theories with unsubstantiated research. Dr. Miller is actually using research conducted by peers and supported by the AAP to buttress his own methodology.

Parents' Response to DHS's Motion to Exclude Parents' Expert Witness, 6/2/20, at 4-6 (unnumbered).

At the start of the hearing on June 26, 2020, the trial court asked counsel if it needed to hear oral argument on the at-issue ***Frye*** motions, and all parties agreed to rest on their filings. N.T., 6/26/20, at 8-9. The trial court then denied DHS's and GAL's motions to preclude Dr. Miller from testifying, stating that it would give the experts' opinions "the weight [it] believes they deserve." ***Id.*** at 9; ***see also id.*** at 19 (the trial court's stating, after Parents offered Dr. Miller as an expert in pediatric medical genetics and bone health,

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[13] ***See*** Högberg U., Andersson J., Högberg G., Thiblin I. (2018) *Metabolic bone disease risk factors strongly contributing to long bone and rib fractures during early infancy: A population register study.* PLoS ONE 13(12):e0208033. https://doi.org/10.1371/journal.pone.0208033.

that it is "going to accept him at this juncture, and [it] will give the appropriate weight").

Subsequently, on direct examination, Dr. Miller testified to the following:

> [Mother's attorney:] So, Dr. Miller, did you prepare a report in this case?
>
> [Dr. Miller:] I did.
>
> [Mother's attorney:] And in preparing your report, what did you review? What documents did you review to prepare your report?
>
> [Dr. Miller:] Initially, I was sent by the parents the medical records of the twins…, and subsequently, I believe after you became involved, you provided me with … some of the medical history and delivery and pregnancy history and … the diagnostic imaging studies.
>
> [Mother's attorney:] Okay. And after viewing all of the documents provided to you, did you arrive at a conclusion?
>
> [Dr. Miller:] I did.
>
> [Mother's attorney:] And can you state the conclusion for the record?
>
> [Dr. Miller:] I thought the twins had [MBDI] and that was a plausible alternative explanation for the fractures.
>
> [Mother's attorney:] Specifically, could you tell the [c]ourt how you got to that conclusion? What principles, scientific or technical, did you rely on to get to your conclusion?
>
> [Dr. Miller:] The information that I relied on includes both my own personal experience with this issue, which dates back to 1994, as well as to additional observations that I read in the medical literature and heard at various scientific meetings, which eventually led me to this entity which is called [MBDI].
>
> In 1994, I saw[,] as a medical geneticist[,] a young infant similar to …[C]hildren here, several months' old[,] which [*sic*] presented with unexplained fractures….

So at that time[,] the one medical disorder that child abuse pediatricians accepted as a plausible medical explanation was a genetic condition called osteogenesis imperfecta, or OI.

At that time[,] there was no DNA test for that but a biochemical test.

The problem with the biochem[ical] test was [that it was] 85 percent accurate, [and had a]15 percent false negative rate. That means if a hundred children with OI were tested and truly had OI as the explanation for fractures, 15 would have a normal test even though they had OI.

When I explained this to the mother, she got very angry at me and asked me how I could present a test that could take children away from parents when the test was as inaccurate as I just described….

So she tasked me with finding an alternative way to judge if somebody could have weak bones.

Long story short, I found a bioengineer, Dr. Tom [Hangartner,] who had a very sophisticated and sensitive method for measuring bone density called CT, or computer topography, bone density. And we engaged in clinical research over the next 20 years.

One of the articles showed that many infants with unexplained fractures have … low CT bone density, and I emphasize the "CT" because [its] the most sensitive way of measuring bone density known to man. That's a very important determinant of bone strength.

So early in my explanation [*sic*] of this issue, it became apparent that, though the x-rays were read as normal, the children with unexplained [fractures] had low bone density.

The other observations I made[were that] many infants were confined inside the womb; that is, they didn't move well. That has relevance to the present case because any time a baby doesn't move well in the womb in [the] third trimester[,] … the fetus … has decreased bone loading. The bones will be diminished in strength at birth.

I think it's important that I give the [c]ourt an explanation of bone loading to give you a better idea of what I mean.

The bone is a smart organ. Within it, there is a brain that tells the bone whether or not it's an environment of low or high bone loading.

If you take an astronaut, he has normal bone strength, normal bone loading. When you send that astronaut to outer space for three months, that astronaut will have unloaded his skeletal system; bones will be weaker. Even when that astronaut returns to [E]arth eight months later, his bones are weaker and [he] has a greater risk of fractures with typical forces.

As he remains on [E]arth over the next bit of time, the bones get stronger because the sensor in the bones now realizes his bones are back on [E]arth and they have the increased bone strength.

The other side of the coin is people with very, very strong bones, because the bone sensors sense the increased loading. An example is a gymnast. They constantly put load on arms and legs with tumbling and jumping.

What I did and published in 1999 in Calcified Tissue International with Dr. [Hangartner] was the concept that bone loading from the third trimester is probably the most important determinate of bone strength in an infant when it [*sic*] is born.

So that's my contribution, my personal experience.

But then I learned about other factors that play into fetal bone strength and young infant bone strength. Those factors include the following:

Number one, whether or not the mother may or may not have diabetes during the pregnancy; number two, whether or not the baby may be premature; number three, whether or not the mother might have a vitamin D deficiency in the pregnancy.

The next issue is whether or not the mother or infant may be taking drugs to interfere with the absorption of calcium and phosphate.

Another issue is whether the infant is small for gestational age and did not grow well in utero.

So a number of factors became apparent to me, not in my work but others, and so I put the idea that this bone strength of a young infant in the third trimester fetus is determined by

> multiple factors. Any time one or more is compromised, it could cause a bone fragility state. When born, that infant is at risk for fractures in the first six months of life. And those can occur with routine handling, can occur with circumcision, with putting on diapers or changing clothes. It could occur with chest physiotherapy for treatment of bronchiolitis.
>
> So that's the state of affairs that I arrived at, that multiple factors determine fetal and young infant bone strength. Anytime I see a situation where there's several factors present, I think that's a plausible medical explanation.
>
> That's basically what my report says.

Id. at 20-28.

Specifically, when asked to summarize the risk factors he considered in reaching his conclusion regarding Children's injuries in particular, Dr. Miller stated:

> So, number one, the risk factors for [MBDI] include the following: [m]aternal vitamin D deficiency likely during the pregnancy; maternal calcium and phosphate deficiency during the pregnancy because of the medications their mother was taking; most importantly, the decreased fetal bone loading from the intrauterine confinement; the intrauterine growth retardation, the fact that both infants were small; and, again, what you asked me about the Zantac medication [taken] by both infants which, again, can cause an increased risk o[f] fractures.

Id. at 31-32.

On cross-examination, Dr. Miller testified that genetic tests cannot detect MBDI, and that "[t]he diagnosis of [MBDI] is strongly inferred by reading of the x-rays." ***Id.*** at 38. Further, he agreed that as long as one of the above-stated risk factors is present, a baby could have MBDI, ***see id.*** at 48, and reiterated that "x-rays are often the telling study that will allow us to jump on that diagnosis." ***Id.*** at 49. Dr. Miller explained that, regarding x-ray

findings, "what I typically do is make a PowerPoint of the imaging studies that I think are relevant. I send them to [Dr. Ayoub, a radiologist with whom Dr. Miller regularly consults]. I have my own opinions based on what he's taught me, and then he sends me back the mocked-up PowerPoint presentation." ***Id.*** at 64.

Moreover, when challenged on cross-examination about when Dr. Miller would find that child abuse caused unexplained fractures instead of MBDI, Dr. Miller answered that it would require "a noncoerced confession; an impartial eyewitness; and third, a videotape. You have those, then you can unequivocally say there was abuse if you have one of those types of affirmation." ***Id.*** at 59. Later, when asked on re-direct examination why Children did not have any bruising consistent with some kind of infliction of injury, Dr. Miller opined:

> We are led to believe these rib fractures are caused by tight gripping and shaking of the infant. There should be grip marks, if the child was looked at [by healthcare providers] so completely and so many times over that period of time [between birth and M.R.'s June 2, 2019 hospital admission].
>
> And … I can't emphasize this enough and it's in my report…[,] whenever you have four or more rib fractures, the Garcia article of 1990[,[14] cited in Dr. Miller's study,] states unequivocally you will always see severe internal lung damage that compromises the child's ability to breath and [the child] will have respiratory distress.
>
> Both twins have more than four rib fractures. Neither ever had severe lung trauma or respiratory distress. That's a very compelling reason, along with the lack of bruising, that makes me

[14] ***See*** Garcia V.F., Gotschall C.S., Eichelberger M.R., Bowman, L.M. *Rib fractures in children: a marker of severe trauma.* J TRAUMA 1990; 30:695-700.

> very comfortable saying that this is highly unlikely [to be] child abuse.

Id. at 73-74.

Following Dr. Miller's testimony, DHS called Dr. Servaes as a rebuttal witness. With respect to Dr. Miller's study published in the Journal of Pediatric Endocrinology and Metabolism, she explained that she, along with another pediatric radiologist, a geneticist, and an attorney, prepared a letter refuting that study on behalf of the Society for Pediatric Radiology ("SPR") Child Abuse Committee after the article

> was brought to our attention[,] … primarily because of it[s] flawed methodology and inaccurate conclusions and suppositions that are within it[. T]he descriptions of the cases are not accurately portrayed; … the images are not reflective of what's described; and even the literature that's utilized to substantiate their arguments is not used in an appropriate fashion.
>
> So we find the methodology is flawed and the conclusions are erroneous and that the use of that article both in terms of treating patients as well as in a court of law is problematic.

Id. at 83. Dr. Servaes explained that SPR is a national, professional society representing pediatric radiologists, and is "tasked with the responsibility of trying to oversee the way we practice imaging" for diagnosing child abuse. ***Id.*** at 87. She said that SPR has "had activities ranging from publishing studies or consensus documents or volunteering to help to determine which studies help us to decide what … the best imaging is to do and how to do imaging appropriately in trying to make this decision." ***Id.*** She added that SPR wrote the letter because MBDI is a "sort of fantastic diagnosis that can't be tested by [a] laboratory and has a disappearance over time." ***Id.*** at 90.

Dr. Servaes also criticized Dr. Miller's use of the Garcia article to support the proposition that, when children have four or more rib fractures, they will always have significant respiratory issues. ***Id.*** at 84. Dr. Servaes said it was inappropriate for Dr. Miller to draw that conclusion from that study because many children in that study were the victims of automobile accidents, and had sustained significant injuries that landed them in the intensive care unit. ***Id.*** at 85-86. Therefore, Dr. Servaes said it is not appropriate to draw the conclusion from that study, that every time a child has four or more rib fractures, he or she will experience respiratory distress. ***Id.*** at 85.

Additionally, Dr. Servaes disputed Dr. Miller's finding of rickets only at specific ribs, explaining that "rickets is a systemic disease that affects the entire body, the bones throughout the skeleton in a very symmetric fashion[,]" and therefore rickets would not occur at only certain ribs. ***Id.*** at 91. She also testified to the following:

> [DHS:] So would you disagree with Dr. Miller's opinion that [C]hildren['s] having risk factors for vitamin D deficiency in the womb would somehow, therefore, give a heightened level of potentiality to have bone fragility?
>
> [Dr. Servaes:] So it's important to think about risk factors and take that into consideration, but the evidence is what the x-rays look like and what the laboratory values are and the pattern. You have to take the entire picture, not just single aspects and decide, because this one thing is present, the conclusion is drawn. You have to look at the entire picture.
>
> [DHS:] So, for example, in this case, the fact that they did the studies in terms of finding out what … [C]hildren's levels of vitamin D, alkaline phosphate, calcium, did those scans [*sic*] and pulled a history and also did genetic testing that was indicated, putting all

> those pieces together is how, in the medical community, one would arrive at [a] proper diagnosis?
>
> [Dr. Servaes:] That's correct. So because there was a risk of vitamin D deficiency[,] having tested … [C]hildren when they came to the hospital, that helps to disprove that that is a cause of their fractures.

Id. at 94-95.

Finally, with respect to Dr. Miller's use of x-rays, Dr. Servaes testified that:

> [O]ne of the issues that came to my mind as Dr. Miller was speaking was that he shared the radiographs with PowerPoint. That's not a sufficient way to view the x-rays. You do not get the appropriate level of anatomic detail.
>
> In radiology[,] imaging is what we do, and we use very high-resolution monitors to look at x-rays, and x-ray in particular is very sensitive the quality of the image.
>
> And we do our imaging studies in a very precise way so that we could see the detail of the entire feature of the bone. We have to look at where the bone is growing. Particularly in children, that is important. And in cases where … there is a concern about child abuse and looking at the bones, it's very important that we have standards that describe precisely how to obtain those x-rays.
>
> And so the quality is degraded by putting it into a PowerPoint and [it] compresses the image and you lose some of the quality as … you can't depict it as well as if you looked at it on a diagnostic monitor….
>
> For someone to provide expert opinion about these x-rays based upon PowerPoint images is not adequate diagnostic information, and I disagree with the conclusions that they've drawn and many of the findings that are described in the reports such as … talking about the widened ribs consistent [with] rachitic rosary; that's not present. The clubbed radius is not a finding there. The picture framing of the vertebrae is not there. The growth arrest lines are present in one of the children; that's a very nonspecific finding. The bones are not osteopenic in either child…. The subperiosteal new bone formation is a finding that's present. It's not … reflective of metabolic bone disease but of healing fractures because these

> are an asymmetric and irregular pattern. It doesn't represent a systemic disease.

Id. at 97-99.

On cross-examination, Dr. Servaes acknowledged that when she and several other authors sent the letter to the Journal of Pediatric Endocrinology and Metabolism, the journal did not retract the publication of Dr. Miller's article. ***Id.*** at 112. However, when asked if the Journal of Pediatric Endocrinology and Metabolism was an established journal, Dr. Servaes responded that "my definition of 'established' … might not fit in this case because my … understanding is that that is a journal in which you pay to publish…." ***Id.*** at 118. Dr. Servaes also recognized that other physicians have studied MBDI, noting:

> [Mother's attorney:] And you talked about how Dr. Miller is the only doctor out there making this diagnosis of [MBDI]; is that fair to say?
>
> [Dr. Servaes:] No, he's not. I think there's a few other physicians who join him.
>
> [Mother's attorney:] So you are aware of the study done in 2018 … by a conglomerate of Swedish doctors who also did the same kind of testing … done by Dr. Miller and his cohorts regarding brittle bone disease?
>
> [Dr. Servaes:] I know -- I am not sure if I know the specific study you are talking about.
>
> ***
>
> [Mother's attorney:] I will reference the peer review article that appeared in the journal that was published as a study done in Sweden in 2018. The lead author is [Ulf Högberg]?
>
> [Dr. Servaes:] Yes.
>
> [Mother's attorney:] Are you aware of that article?

> [Dr. Servaes:] Yes.
>
> [Mother's attorney:] Are you aware in that article that was published there was 47 references to other studies that they used to get to their conclusions? Are you aware of that?
>
> [Dr. Servaes:] Okay. Yes.

Id. at 113-14.

Trial Court Opinion

In light of the foregoing, especially the testimony adduced at the adjudicatory hearings, the trial court gave the following explanation in its Pa.R.A.P. 1925(a) opinion for admitting Dr. Miller's testimony:

> Dr. Miller's testimony clearly meets the … requirements under [Rule] 702. Dr. Miller's educational and employment qualifications [and employment] as the Director of Medical Genetics at Dayton Children's Hospital helped this [c]ourt determine the central fact at issue: whether there was an underlying cause other than child abuse for … Children's injuries. As a geneticist who issued a report on this case, Dr. Miller had the requisite knowledge, skill[,] and training in order to render a medical opinion on this case. Additionally, Dr. Miller's report was generated on diagnostic testing and medical records made available to all of the experts testifying in this matter; therefore, his conclusions were based upon sufficient data.
>
> Dr. Miller's methodology was also sufficient as to qualify him as an expert witness. Although the expert witnesses disagreed with Dr. Miller's conclusions, Dr. Miller's study regarding MBDI was published in [t]he Journal of Pediatric Endocrinology and Metabolism. (N.T.[,] 6/26/20[,] at 83). The journal is peer-reviewed, so selection for publication in the journal demonstrates an acceptance of his theory within the medical community. (***Id.*** at 112). Further, upon criticism from Dr. [Servaes] and her peers, the journal declined to retract the study, which further supports the acceptance of Dr. Miller's methodology by his peers in the medical community. (***Id.***). Additionally, Dr. Servaes acknowledged that other doctors have joined Dr. Miller's theory and similar studies have been published. (***Id.*** at 113). Furthermore, in making his report, Dr. Miller examined medical records, diagnostic imaging[,] and the medical histories of both …

> Children and Mother. (***Id.*** at 21). Notably, these diagnostic tests and tools were also utilized by DHS'[s] expert witnesses in making their reports. (N.T.[,] 2/7/20[,] at 49, 58, 60, 138-[3]9, 142-[4]4). Although there is not a specific genetic test for MBDI, Dr. Miller relies on other medical diagnostic tools, such as medical histories and maternal health histories. (N.T.[,] 6/26/20[,] at 67). Dr. Miller used these reports and his professional knowledge to form his report regarding … Children. (***Id.*** at 21). Specifically, he used medical histories and the same diagnostic testing to form his opinion with a different result. Therefore, the testimony of Dr. Miller clearly satisfies the standard required by [Rule] 702.

TCO at 10-11.

Analysis

Both DHS and GAL attack the trial court's above-stated rationale. They argue that Dr. Miller has not applied a generally accepted scientific methodology to reach his conclusion that MBDI caused Children's fractures. We agree.

To begin, the trial court emphasized in its analysis that the Journal of Pediatric Endocrinology and Metabolism published Dr. Miller's study and that other, similar studies have been published.[15] While we recognize that scientific publications and studies are ways in which an expert's methodology can be shown to be generally accepted in the relevant field, ***see Hopkins***, ***supra***, we concur with DHS that "the mere fact of publication is not enough to establish general acceptance, especially where the medical establishment's reaction to those publications has been opprobrium and concern over the

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[15] Though the trial court mentions "studies," Parents only specifically refer to one similar study in their briefs; that is, the study by Högberg, cited *supra*, which Dr. Servaes acknowledged at the hearing. ***See*** Mother's Brief at 24-25; Father's Brief at 13.

misuse of TBBD/MBDI in the courtroom." DHS's Brief at 22. Both the Society of Pediatric Radiology and the *Diagnostic Imaging of Child Abuse* textbook have pointed out flaws in Dr. Miller's scientific methodology, such as, *inter alia*, the bias involved and Dr. Miller's refusal to acknowledge more reasonable explanations for a child's injuries, like abuse. As DHS observes:

> The value of the peer[-]review process is not simply in an article's being green-lit for publication by a journal's editorial board or reviewers. Rather, the purpose of publication is to stimulate scientific discourse. Publication allows other scientists to test the theory by examining and critiquing a study's methodology, or by attempting to replicate or falsify its results. It is this broader dialogue of publication and response that generates a scientific consensus about the theory's reliability. ***See Daubert v. Merrell Dow Pharm., Inc.***, 509 U.S. 579, 593 (1993) ("Publication (which is but one element of peer review) is not a *sine qua non* of admissibility; it does not necessarily correlate with reliability…[.] But submission to the scrutiny of the scientific community is a component of 'good science,' in part because it increases the likelihood that substantive flaws in methodology will be detected.").

DHS's Brief at 30-31. In addition, the fact that other doctors have published a similar study does not automatically make Dr. Miller's methodology generally accepted in the scientific community. That study may contain the same flaws as Dr. Miller's research. DHS astutely notes:

> Parents point to just one source used to assess general acceptance: whether any peer-reviewed, published research exists on the topic. But they ignore all of the other sources, including: how the field has reacted to peer-reviewed research supporting the expert's theory; the views of professional organizations in the field; whether the technique is taught in textbooks; the testimony of other experts; and how other courts have treated the methodology.

DHS's Reply Brief at 1-2 (citation omitted). Thus, we disagree with the trial court that publication proves that doctors and scientists in the medical field generally accept Dr. Miller's scientific methodology as a means for arriving at the conclusion that MBDI caused Children's injuries, especially when considering the plethora of other sources discrediting his methodology.

Furthermore, we reject the trial court's determination that Dr. Miller used the same scientific methodology as the CHOP and Nemours doctors, in that he examined medical records, diagnostic imaging, and the medical histories of both Children and Mother to reach his conclusion of MBDI. DHS discerns:

> Here, Dr. Miller's method of interpreting the [x]-rays was itself not generally accepted. Dr. Servaes, a pediatric radiologist, explained that Dr. Miller did not use a generally accepted method to interpret the radiographs because he and his consulting radiologist, Dr. Ayoub, viewed them in a compressed version on PowerPoint instead of using the proper imaging equipment.
>
> Dr. Servaes also explained that Dr. Miller had not interpreted the x-rays correctly, as he had labeled normal, healthy features as evidence of "rickets" or other bone defects. Her testimony is consistent with the findings of the entire CHOP SCAN team and Parents' geneticist Dr. Bober … that … Children's bones were well-formed and there was no evidence of rickets. Indeed, Dr. Miller's "methodology" of discovering non-existent bone defects in x-rays is not unique to this litigation: the Society for Pediatric Radiology's response to Dr. Miller's published article specifically criticized Dr. Miller and Dr. Ayoub for this tactic, including their habit of "calling normal bones 'rickets[.'"]
>
> The trial court also pointed to Dr. Miller's claimed reliance on "diagnostic testing" and "medical histories[."] In reality, his opinion was not based on any diagnostic testing, as that testing had ruled out any medical risk factors for bone fragility such as vitamin D deficiency. As for … Children's medical history, it is

> unclear how that alone could support <u>any</u> diagnosis, as Parents provided no explanation for … Children's injuries.

DHS's Brief at 35-36 (emphasis in original).

Indeed, Dr. Miller emphasized that "[t]he diagnosis of [MBDI] is strongly inferred by reading of the x-rays[,]" and that "x-rays are often the telling study that will allow us to jump on th[e] diagnosis" of MBDI. N.T., 6/26/20, at 38, 49. However, as DHS argues, Dr. Miller's method of interpreting the x-rays was itself not generally accepted by the medical community, given the testimony of Dr. Servaes regarding the use of PowerPoint to view x-rays, the findings of other doctors at CHOP and Nemours that Children's bones were normal, and the Society for Pediatric Radiology's critique of Dr. Miller's published article that he mischaracterized normal bones as rickets. Further, Dr. Servaes testified that, in making a proper diagnosis, it is "important to think about risk factors and take that into consideration, but the evidence is what the x-rays look like and what the laboratory values are and the pattern. You have to take the entire picture, not just single aspects and decide, because this one thing is present, the conclusion is drawn. You have to look at the entire picture." ***Id.*** at 94.[16] Here, unlike the other doctors who

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[16] Other doctors at the hearing also spoke to the importance of looking at the 'entire picture' and Children's lab tests in making a diagnosis. ***See also*** N.T., 2/7/20, at 84 (Dr. Henry's testifying that "[s]o, in regards to the cause, these children's fractures are most consistent with physical abuse. And I want to sort of explain the reason. … [W]e have a negative evaluation, or a normal evaluation[,] by our colleagues in bone health. The genetic testing that has been performed to date has been negative. We have a third skeletal survey that does not show additional injuries. And we know that rib fractures in and

evaluated Children, Dr. Miller did not consider the 'entire picture,' in particular the results of Children's lab tests, in making his diagnosis of MBDI. Instead, Dr. Miller essentially ignored these tests and drew conclusions based on a purported risk factor being present. ***See*** N.T., 6/26/20, at 48 (Dr. Miller's testifying that, as long as one risk factor is present in an infant, that infant could have MBDI). Thus, the trial court abused its discretion in ascertaining that Dr. Miller applied a generally accepted scientific methodology simply because he claimed to have used medical records, diagnostic imaging, and the medical histories of both Children and Mother. Accordingly, as Parents did not meet their burden of showing that the medical community generally accepts the scientific methodology used by Dr. Miller in reaching his conclusion that MBDI caused Children's fractures, we hold that the trial court should not have admitted Dr. Miller's testimony.

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of themselves are highly specific for abuse. So, these findings are all consistent with trauma as the cause. We don't have a plausible … accidental mechanism, and for that reason, these findings are most consistent with abuse."); ***id.*** at 147-48 (Dr. Skraban's testifying that there was not a medical cause for Children's injuries as "the calcium, and the phosphorus, and the vitamin D [levels] were looked at, both from a nutritional perspective, but [there are] also genetic causes of rickets, for example, of which you … would expect the same underlying differences … in those things, in the calcium, phosphorus, and alkaline phosphatase. And, so, it's not only helpful from a nutritional perspective, but it's also helpful from a genetics perspective to see that all of those levels were normal. And, so, of the other common genetic conditions that would cause fractures in infancy, having those normal levels … was reassuring."); ***id.*** at 149-51 (Dr. Skraban's testifying that Dr. Bober at Nemours reviewed Children's lab tests and x-rays to rule out any underlying metabolic bone disease or genetic condition as a cause of their injuries).

The exclusion of Dr. Miller's testimony affects the trial court's finding on child abuse. In not finding child abuse as to Parents, the trial court provided:

> The petitioning party in a dependency action must demonstrate the existence of child abuse by clear and convincing evidence. 23 Pa.C.S.[] § 6381(d); ***[s]ee In re L.Z.***, 111 A.3d [1164,] 1179[(Pa. 2015)]. However, the identity of the abuser need only be established by *prima facie* evidence. (***Id.***). The Child Protective Services Law provides for the following evidentiary presumption:
>
> > Evidence that a child has suffered child abuse of such a nature as would ordinarily not be sustained or exist except by reason of the acts or omissions of the parent or other person responsible for the welfare of the child shall be *prima facie* evidence of child abuse by the parent or other person responsible for the welfare of the child.
>
> 23 Pa.C.S.[] § 6381(d). In the application of Section 6381(d), "evidence that a child has suffered injury that would not ordinarily be sustained but for the acts or omissions of the parent or responsible person is sufficient to establish that the parent or responsible person perpetrated that abuse unless the parent or responsible person rebuts the presumption." ***See In re L.Z.***, 111 A.3d at 1185.
>
> Here, DHS failed to establish a *prima facie* case of child abuse because they failed to demonstrate that … Children were victims of child abuse. Although the medical experts offered by DHS concluded that … Children's injuries resulted from child abuse, Dr. Miller's theory contradicted this testimony. (N.T.[,] 2/7/20[,] at 84, 86-[8]7; N.T.[,] 6/26/20[,] at 21). Dr. Miller's testimony presented an alternative medical explanation for the injuries … Children suffered other than child abuse. His testimony that … Children suffered from MBDI demonstrates an alternative and accidental cause for … Children's injuries. Because, according to Dr. Miller's expert testimony, MBDI could have plausibly caused the multiple rib fractures, DHS failed to establish clear and convincing evidence that … Children were victims of child abuse. (N.T.[,] 6/26/20[,] at 26). Therefore, absent clear and convincing evidence that child abuse occurred, there is no *prima facie* evidence Parents were the perpetrators of child abuse. For the foregoing reasons, this [c]ourt properly declined to make a child abuse finding as to Parents.

TCO at 12-13.

As the trial court abused its discretion in admitting Dr. Miller's testimony pursuant to Rule 702 and ***Frye***, its explanation for not finding child abuse against Parents falters. Without Dr. Miller's testimony, it is evident that DHS has demonstrated child abuse by clear and convincing evidence; all of the remaining evidence in the case overwhelmingly points to abuse as the cause of Children's injuries.

"The term 'child abuse' shall mean intentionally, knowingly or recklessly doing any of the following: (1) Causing bodily injury to a child through any recent act or failure to act." 23 Pa.C.S. § 6303(b.1)(1). 'Bodily injury' is defined as "[i]mpairment of physical condition or substantial pain." 23 Pa.C.S. § 6303(a). "The requisite standard of proof for a finding of child abuse pursuant to Section 6303(b.1) is clear and convincing evidence." ***Interest of A.C.***, 237 A.3d 553, 558 (Pa. Super. 2020) (citation omitted). "Clear and convincing evidence is 'evidence that is so clear, direct, weighty, and convincing as to enable the trier of fact to come to a clear conviction, without hesitancy, of the truth of the precise facts in issue.'" ***Id.*** (citation omitted). Moreover, "[t]he standard of review in dependency cases requires an appellate court to accept the findings of fact and credibility determinations of the trial court if they are supported by the record, but does not require the appellate court to accept the lower court's inferences or conclusions of law. Accordingly, we review for an abuse of discretion." ***Id.*** at 557 (citations omitted).

As GAL aptly states:

> The trial court's [o]pinion confirms the existence of clear and convincing evidence … that Parents intentionally, knowingly[,] or recklessly caused bodily injury to … [C]hildren through their actions or failure to act; [the trial court] wrote:
>
> - Dr. Henry testified that (1) … [C]hildren had no underlying genetic conditions or underlying bone conditions that could have caused the injuries, (2) that … [C]hildren showed paradoxical fussiness that can be indicative of pain from rib fractures, (3) that Mother denied any accidental trauma, (4) that there was no family history of bone disease, (5) the amount of force required for rib fractures is rarely seen in accidental injuries, and (6) … [C]hildren's fractures were most consistent with abuse. [TCO at 3-4.]
>
> - Dr. Skraban concluded that [(1)] the [x]-rays were normal with no sign of an underlying genetic condition or bone demineralization, (2) Dr. Bober confirmed CHOP's findings, and (3) … [C]hildren did not have osteogenesis imperfecta. [***Id.*** at 4].
>
> The trial court further stated that Mother testified "she was … the primary caretaker of … [C]hildren, but family members frequently visited." [***Id.*** at 5; ***see also*** N.T., 2/7/20, at 221-24.] As such, there is *prima facie* evidence that Parents were responsible for … [C]hildren.[17]

GAL's Brief at 45-46 (internal citation omitted). We agree that DHS presented clear and convincing evidence to establish child abuse by Parents. Thus, we reverse the trial court's orders, and direct it to make a finding of child abuse as to Parents for each child.[18]

Orders reversed. Case remanded. Jurisdiction relinquished.

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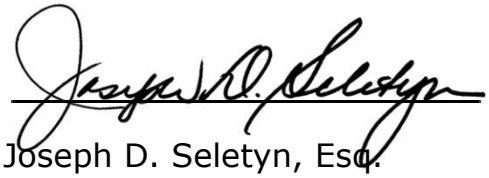
[17] ***See also*** N.T., 2/7/20, at 222 (Mother's testifying that Children were in her care throughout the day until Father came home from work).

[18] Given our disposition, we need not address the remaining issues raised by DHS and GAL.

Judgment Entered.



Joseph D. Seletyn, Esq.
Prothonotary

Date: 3/1/21