HAIR DRUG TESTING OF CHILDREN: A STUDY OF UTILIZATION AND INTERPRETATION

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I. BACKGROUND

Childhood exposure to caregivers with substance use disorders can overlap with child maltreatment and neglect.[1] Such exposure is considered an adverse childhood event contributing to increased risk of long-term mental and physical health complications.[2] Children living in environments where parents use substances may experience anxiety disorders, ADHD, and depression, in addition to other trauma and stress-related disorders.[3]

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[1] Kaitlyn Petrucelli et. al., *Adverse Childhood Experiences and Associated Health Outcomes: A Systematic Review and Meta-analysis*, 97 Child Abuse and Neglect 1.1-13 (2019).

[2] *Id.*

[3] Vincent C. Smith, et. al., *Families Affected by Parental Substance Use*, 138 AM. ACAD. OF PEDIATRICS, E1, E5 (2016).

Additionally, as compared to children of parents without substance use disorders, children of parents with substance use disorders are three times as likely to be abused physically, emotionally or sexually and are four times as likely to be neglected.[4] Exposure to illicit substances can also put children at risk of direct harm from ingestion, and in Arkansas, it is considered child abuse to "[give] a child or [permit] a child to consume or inhale a poisonous or noxious substance not prescribed by a physician that has the capacity to interfere with normal physiological functions."[5] Due to the risk of harm associated with "[a]n addicted parent's illegal drug use and instability," Arkansas courts have previously found it can be in the best interest of a child that parents with persistent, unremedied drug use should have their parental rights involuntarily terminated.[6] With significant risks associated with caregiver substance use, and significant legal consequences attached thereto, the identification of children exposed to substances can provide an opportunity to intervene and protect children from potential harm.

Hair drug testing is one modality to identify children exposed to illicit substances. The process of hair drug testing typically includes a collection of a 1.5-inch sample of hair, cut at the level of the scalp, allowing for testing of an approximate three-month window of drug ingestions based on an estimated 0.5-inch of hair growth per month.[7] Hair testing for adults involves a laboratory process of washing the hair of any external residue prior to testing to isolate drugs which have been ingested and grow out into the hair follicle.[8] However, the same is not always true for children in whom the concern is not individual use but exposure to a drug-endangered environment.[9] Hair drug testing to identify environmental exposures does not include laboratory washing prior to testing and may identify drug residue or smoke adhering to the hair in addition to ingestions.[10] Depending on the lab and tests requested, hair drug tests may vary as to the individual substances.[11] However, most tests can detect commonly abused substances including amphetamines, cannabinoids, cocaine, opiates, PCP (phencyclidine), benzodiazepines, and barbiturates. Hair drug tests involve a confirmatory testing process and when positive, indicate an exposure to

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[4] *Id.* at e4.

[5] Ark. Code Ann. §12-18-103 (2010).

[6] Bratton v. Dep't of Human Servs., 586 S.W.3d 662, 666-67 (2019).

[7] Fritz Pragst, et. al., *State of the Art in Hair Analysis for Detection of Drug and Alcohol Abuse*, 370 CLINICA CHIMICA ACTA, 17, 18-26 (2006).

[8] *Id.*

[9] *Id.*

[10] *Hair Exposure Drug Testing (ChildGuard®)*, *UNITED STATES DRUG TESTING LABORATORIES*, https://www.usdtl.com/testing/child-hair-drug-test-labs (last visited Nov. 9, 2022).

[11] *Id.*

the specific substance identified with a quantified level of the substance detected.[12]

Despite the relative simplicity of collecting hair, sending it to a lab, and getting a report of any substances detected, the interpretation of positive and negative hair drug tests for children presents certain complications. When a hair drug test is evaluating for substance exposure, a positive result is often unable to differentiate purely environmental exposures -- with external residue adherent to the hair -- from subjects who have experienced direct harm or abuse through actions such as ingestion, inhalation, or other systemic exposure to a poisonous or noxious substance.[13] A positive hair drug test is also unable to identify the specific route, timing, or extent of exposure based on the results.[14] While there are quantified levels of a substance reported with a positive hair test, multiple factors contribute to the levels detected, and there is no evidence basis to correlate any quantified level to the type or extent of exposure.[15] For instance, a child presenting for hair drug testing directly from an environment where caregivers were smoking an illicit substance may have a hair drug test positive for a substance detected at many times over the cutoff limit of detection without a detectable amount of drug entering the body through ingestion or inhalation. In contrast, a child with a potentially life-threatening ingestion months prior to the test may have a lower level detected.[16]

Another challenge to interpreting hair drug tests is the fact that the estimated timeline or window of detection for substances in children and infants is imprecise and impacted by various factors. In general, hair drug tests are thought to detect drug ingestions for up to three months based on rates of hair growth and the size of the sample sent for testing.[17] However, this timeline is an estimation based on adult drug use. Moreover, there is individual variability in rates of hair growth; factors such as age, race, and health can influence how quickly hair grows which will therefore impact the window of detection for drug ingestions.[18] Additionally, the likelihood of a positive hair drug test from a purely environmental exposure is impacted by multiple individual and cultural factors such as frequency of hair washing, hair products, and hair dye.[19] Studies of adult hair drug testing have also suggested that factors such as race and hair color may influence the

[12] Pragst, *supra* note 8, at 27-29, 32.
[13] *Id.*
[14] *Id.*
[15] *Id.*
[16] *Id.* at 30.
[17] *Id.*
[18] *Id.* at 33-36.
[19] Sharon Levy, et.al., *Testing for Drugs of Abuse in Children and Adolescents*, 133 PEDIATRIC DIG., e1798, e1799 (2014).

likelihood of a positive hair test.[20] In sum, hair drug tests for children may be more or less likely to be positive or negative based on a multitude of factors unrelated to drug exposure.[21]

In addition to the difficulties in technical interpretation of hair drug testing in children, it is also impossible to assign or quantify individual risk of maltreatment or harm based on hair drug testing alone. Although there is epidemiologic and population data identifying many risks of caregiver substance use as it relates to child maltreatment and adverse outcomes, population data cannot tell us the likelihood of harm to an individual child.[22] Similar to how obesity puts people at risk for diabetes without indicating that every obese individual actually has diabetes, drug use in a home can put children at risk for maltreatment and harm but it does not necessarily indicate that every child in a home with caregiver substance use has been directly harmed. When it is not possible to identify when or how a child was exposed, or whether a positive test indicates an ingestion or external residue, it is not possible to state with certainty that the child was harmed or maltreated as a result of the exposure.

Considering the multitude of factors contributing to the likelihood of a hair test being positive or negative as well as limited information to guide the assessment of risk given a positive or negative test, hair drug testing results must be interpreted with caution. Recognizing the limitations of hair drug testing is critical if the tests are being used to assess for safety. When hair testing is evaluated for exposure to substances, a negative hair test cannot exclude the possibility of exposure or the associated risks and a positive hair test, while identifying a risk factor, cannot quantify the extent or risk of harm to a child.[23]

Recognizing the complexities in the interpretation of hair drug testing results, in 2003, clinicians with specialized training in the evaluation of maltreatment developed a process at Arkansas Children's Hospital to allow for hair drug testing of children at a specialized outpatient clinic for suspected victims of maltreatment, now called the "Team for Children at Risk" (TCAR) clinic.[24] These clinicians collect hair drug tests and document the results with a detailed explanation of the meaning and limitations of the test. Hair drug testing can be requested by state investigators or caseworkers

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[20] Gary Henderson, et. al., *Incorporation of Isotopically Labeled Cocaine into Human Hair: Race as a Factor*, 22 J. OF ANALYTICAL TOXICOLOGY 156, 156-64 (1998).

[21] Douglas Rollins, et. al., *The Effect of Hair Color on the Incorporation of Codeine into Human Hair*, 22 J. OF ANALYTICAL TOXICOLOGY 545, 545-50 (2003).

[22] D.J.P. Barker, et. al., EPIDEMIOLOGY FOR THE UNINITIATED BJM eds., 4th ed. (1997).

[23] *Id.*

[24] Arkansas Children's Hospital, *Team for Children at Risk*, https://www.archildrens.org/programs-and-services/team-for-children-at-risk?&journey=symptoms (last visited Oct. 31, 2022).

assigned to the evaluation of child maltreatment reports through the Arkansas Child Abuse Hotline, or it may be court-ordered as a part of an ongoing evaluation of child maltreatment.[25]

Since the beginning of this clinical service, requests for hair drug testing in the TCAR clinic have substantially grown from an initial volume of fewer than twenty scheduled visits annually for evaluation of substance exposure in 2004-2005 to more than 300 scheduled visits for evaluation of substance exposure annually from 2019-2021.[26] Despite the growing popularity of this service, there was no evaluation of how the hair drug testing results were being utilized and interpreted by multidisciplinary team members involved in the assessment and response to child maltreatment for more than a decade. In 2020, we aimed to fill this knowledge gap by performing a survey of non-medical multidisciplinary team members involved in the assessment and response to child maltreatment to identify the perceived benefit of hair testing, perceived risk associated with positive and negative hair tests, and the accuracy of interpretation.[27] This article presents and discusses the results of our survey.

II. METHODS

A survey was developed by clinical team members in the Division for Children at Risk at Arkansas Children's Hospital, a division specifically dedicated to the medical evaluation of children at risk for abuse and neglect.[28] Rating scales were developed to measure both perceived benefit of hair drug testing and the accuracy of interpretation of both positive and negative results.[29] Voluntary surveys were sent to more than 300 people, including attorneys ad litem (attorneys for children), parent counsel (attorneys for parents), attorneys for the Department of Human Services (DHS), investigators for the Division of Children and Family Services (DCFS), investigators for the Arkansas State Police, Court Appointed Special Advocates (CASA), and others involved in investigating and responding to child maltreatment.

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[25] ARK. DEPT. OF HUMAN SVCS. DIV. OF CHILDREN AND FAMILY SVCS., POLICY & PROCEDURE MANUAL (Rev. Aug. 2022).

[26] Interview with Karen Farst, M.D., Department of Pediatrics, Section for Children at Risk, April 1, 2022.

[27] *See* Liza Murray, M.D., Hair Drug Testing for Victims of Child Abuse: A Study of Utilization and Interpretation (Aug. 4, 2020) (unpublished research proposal) (on file with UAMS Institutional Review Board).

[28] *See* University of Arkansas for Medical Sciences, Department of Pediatrics Children at Risk, https://medicine.uams.edu/pediatrics/specialties/sections/children-at-risk/ (last visited Oct. 31, 2022).

[29] Murray, *supra* note 27, at 6-7.

Perceived hair drug testing benefit was measured through rating the importance of a positive or negative hair test on a scale of never important to always important. Risk assessment was measured through rating the level of agreement on a scale of strongly disagree to strongly agree with statements of presence or absence of risk to children with a positive or negative hair test. Accuracy of interpretation was evaluated through rating the level of agreement on a scale of strongly disagree to strongly agree with an accurate and inaccurate interpretation of a hair test result.[30] The surveys were developed through REDCap, a secure database and survey building web application.[31]

Survey links were provided by email, and participation was voluntary and anonymous. Requests to participate were sent to Arkansas Division of Children and Family Services (DCFS) Investigators, Arkansas State Police investigators within the Crimes Against Children Division (CACD), attorneys for DCFS, attorneys ad litem, parent counsel, and Court Appointed Special Advocate (CASA) advocates. One reminder email was sent after the initial request for participation.

Statistical analysis was completed with IBM SPSS Statistics 25 and ANOVA testing was used to evaluate any significant differences between groups.[32] This study was approved by the University of Arkansas Institutional Review Board.

III. RESULTS

There were 137 participants: forty-three attorneys ad litem, thirty-six DCFS investigators, twenty-seven Arkansas State Police investigators, eighteen DHS attorneys, seven CASA advocates, four parent counsel, and two identifying as "other."

Most respondents reported that they do consider the results of hair drug tests in their role. Regarding perceived importance, 100% of respondents reported that positive hair drug tests are "usually" or "always" important, and 81.8% reported that negative hair drug tests are "usually" or "always" important. Regarding risk assessment, most respondents considered a positive hair drug test to indicate a risk to children in the home,

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[30] *Id.*

[31] *See generally* Project REDCap, https://projectredcap.org/about/?_gl=1*j50i6x*_ga*MTE1NTczNjgwOC4xNjY3MjE0MjAz*_ga_WSHLZ5232G*MTY2NzIxNDIwMi4xLjAuMTY2NzIxNTQxMS4wLjAuMA..&_ga=2.196880111.2141664962.1667214203-1155736808.1667214203 (last visited Oct. 31, 2022).

[32] Robert Hoyt, et. al., *IBM Watson Analytics: Automating Visualization, Descriptive, and Predictive Statistics*, JMIR PUBLIC HEALTH SURVEILL. (2016).

with 96.4% either "strongly" or "somewhat" agreeing with that statement.[33]

Table 1: Proportion of respondents agreeing with statements of risk and interpretation

	Strongly Disagree	Somewhat Agree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
A positive hair test indicates a risk to the child(ren) in the home	1.5%	2.2%	0	13.9%	82.5%
A negative hair test indicates no considerable risk to the child(ren) in the home	38.7%	28.5%	16.1%	8.8%	8%
A positive hair drug test indicates that a child has been exposed to substances tested within a certain time frame	1.5%	1.5%	1.5%	21.3%	74.3%
A negative hair drug test indicates that a child has not been exposed to substances tested within a certain time frame	29.2%	25.2%	11.7%	19%	14.6%

Conversely, only 67.2% either strongly or somewhat disagreed with the statement "A negative hair test indicates no considerable risk to the child(ren) in the home."[34] Regarding accuracy of interpretation, the majority (95.6%) somewhat or strongly agreed with the correct statement, "A positive hair drug test indicates that a child has been exposed to substances tested within a certain time frame."[35] A smaller majority accurately interpreted a

[33] *See* Table 1.
[34] *Id.*
[35] *Id.*

negative hair test, with only 54.4% of respondents either strongly or somewhat disagreeing with the incorrect statement, "A negative hair drug test indicates that a child has not been exposed to substances tested within a certain time frame." A substantial minority of respondents, 33.6%, inaccurately agreed with that statement.[36]

There was a statistically significant relationship between respondents' professional roles and their perception of the importance of a negative hair drug test ($p < 0.001$), as well as the accuracy of their interpretations of a negative hair drug test ($p=0.021$). A larger proportion of DCFS investigators indicated a negative hair test was "always" important, and a larger proportion of DCFS and CACD investigators inaccurately interpreted a negative hair test as an indication that a child has not been exposed to substances.[37]

Table 2: Importance of a Negative Hair Test by Role (ANOVA <0.001)

Role (N)	Rarely Important N (%)	Occasionally Important N (%)	Usually Important N (%)	Always Important N (%)
DHS Attorney (18)	1 (5.6)	5 (27.8)	5 (27.8)	7 (38.9)
Attorney Ad Litem (43)	1 (2.3)	10 (23.3)	15 (34.9)	17 (39.5)
DCFS (36)	0	3 (8.3)	2 (5.6)	31 (86.1)
CACD (27)	0	4 (14.8)	8 (29.6)	15 (55.6)
CASA (7)	0	0	0	7 (100)
Other (2)	1 (50)	0	0	1 (50)
Parent Counsel (4)	0	0	1 (25)	3 (75)

[36] *Id.*
[37] *See* Table 2; Table 3.

Table 3: Risk Assessment[38] with a Negative Test by Role (ANOVA p = 0.018)					
Role (N)	Strongly Disagree N (%)	Somewhat Disagree N (%)	Neither Agree nor Disagree N (%)	Somewhat Agree N (%)	Strongly Agree N (%)
DHS Attorney (18)	9 (50)	3 (16.7)	4 (22.2)	1 (5.6)	1 (5.6)
Attorney Ad Litem (43)	17 (39.5)	15 (34.9)	6 (14)	4 (9.3)	1 (2.3)
DCFS (36)	14 (38.9)	9 (25)	5 (13.9)	4 (11.1)	4 (11.1)
CACD (27)	11 (40.7)	9 (33.3)	4 (14.8)	1 (3.7)	2 (7.4)
CASA (7)	2 (28.6)	2 (28.6)	2 (28.6)	1 (14.3)	0
Other (2)	0	1 (50)	0	0	1 (50)
Parent Counsel (4)	0	0	1 (25)	1 (25)	2 (50)

IV. DISCUSSION

The accurate assessment of risks to children and harm to children in potentially unsafe or abusive environments is challenging but imperative to prevent ongoing abuse and neglect, and to avoid unnecessary and traumatic disruption to families.[39] Separation of children from caregivers is a distressing and potentially harmful event and while there are circumstances in which it is necessary for a child's safety, removal of a child is not without risk.[40] Utilization of various tools and assessments can be helpful in the response to child maltreatment, but accurate interpretation is crucial to make informed and consistent decisions for the safety of children. Hair drug testing is one of many tools to assess risk and harm to children; however, if results are inaccurately interpreted and inappropriately utilized to assign risk, children and families may be harmed. With this exploratory survey identifying perceived benefit and interpretation of hair drug testing, we have identified substantial variation in interpretation and inaccuracies in the interpretation of results.

[38] Level of agreement with "A negative hair test indicates no considerable risk to the child(ren) in the home."

[39] *See* Vivek S. Sankaran et. al., *Easy Come, Easy Go: The Plight of Children who Spend Less than Thirty Days in Foster Care*, 19 U. PENN. J. OF L. & SOC. CHANGE, 207 (2016).

[40] Kimberly Howard et al., *Early Mother-Child Separation, Parenting, and Child Well-Being in Early Head Start Families,* 13 ATTACHMENT & HUM. DEV. 1, 10-13 (2011).

Given multiple environmental and personal factors (hair washing, dyes, treatments, etc.) which are known to impact hair drug test results, we know that a negative hair drug test of a child cannot exclude the possibility of exposure.[41] However, 16.8% of respondents agreed that "a negative hair test indicates no considerable risk to the child(ren) in the home" and an even larger proportion of respondents (33.6%) incorrectly indicated that "a negative hair drug test indicates that a child has not been exposed to substances tested within a certain time frame."[42] Since most respondents also indicated that a negative hair drug test is perceived as "important,"[43] these results suggest that a negative result could inaccurately impact the action (or inaction) of a team member during an evaluation of suspected maltreatment.

Regarding interpretation of positive drug tests, we know that although a positive hair drug test does indicate that a child was exposed, the test result cannot identify where the child was exposed, how the child was exposed, or precisely when the child was exposed. The vast majority of respondents in this study agreed that a positive hair test indicated a true exposure, and that the positive hair test indicated a risk to the child(ren) in the home.[44] While the statement regarding risk to children may be true, a positive hair test in a child does not necessarily predict that harm will occur to a child in every case, and it is never possible to truly quantify or qualify the level of individual risk based on a hair test result.

Our study had multiple limitations which could impact results, and this small study is not generalizable to the organizations represented as a whole. As with any voluntary survey, results could be impacted by response and non-response bias, and the small number of individuals in each "role" group limits the capacity to detect significant relationships. Despite these limitations, the results are meaningful. With child maltreatment cases in Arkansas being impacted by individual interpretation of hair drug tests and individual response to cases, any variation in interpretation and utilization of hair drug testing is significant to the children and families involved.[45]

However, while this study did not explore specific outcomes or actions associated with hair drug testing results, it highlights several concerning issues. When the likelihood of a positive or negative hair drug test may be influenced by individual, environmental, and cultural factors, an inaccurate

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[41] Fritz Pragst, et. al., *Hair Analysis of More than 140 Families with Drug Consuming Parents. Comparison between Hair Results from Adults and their Children,* FORENSIC SCI. INT. 297; 161-170 (2019).

[42] *See* Table 1.

[43] *Id.*

[44] *Id.*

[45] *See generally* Holt v. State, 2009 Ark. 482, ¶ 4, ¶¶ 9-10. (Although child maltreatment cases are confidential, similar, public decisions illustrate how courts rely on hair drug tests of children as evidence.)

interpretation of the results as a method to "rule in" or "rule out" substance exposure could lead to both over- and under-response in the assessment of a child's safety. If a positive hair drug test is used as proof of harm or potential grounds for removal without consideration of individual, environmental and family factors there is risk of unnecessary trauma to a child and family through child welfare agency intervention. On the contrary, if a negative hair test is considered proof of less or no harm, children may remain in an unsafe environment and families may not receive services that could improve their circumstances and prevent harm from occurring.

The importance of recognizing and responding to child maltreatment cannot be overstated. Caregiver substance use as a risk factor for harm is an issue that should not be ignored. Hair drug testing can provide useful and tangible information to identify a factor contributing to a potentially dangerous environment for children.[46] However, given the multitude of variables contributing to the results and the complexities of individual cases, this test should not be over-utilized or interpreted with a simplistic understanding of risk. Hair drug tests are not able to demonstrate definitive harm or absence of harm.[47] Therefore, over-reliance on hair drug test results in the assessment of maltreatment can contribute to inaccurate assignment of risk and inequitable treatment of at-risk children and families.[48] Given substantial individual variation among multidisciplinary team members and the identification of inaccurate interpretation by individuals involved in the response to child maltreatment in Arkansas, we would caution against over-utilization of hair drug testing in the assessment of child maltreatment. Finally, when drug testing is needed, we recommend consultation with a medical provider who has specialized training in child maltreatment to determine hair drug testing utility and interpretation.

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[46] *Id.*

[47] *See* Colorado Office of Children, Youth, and Families, *Toxicology Resource Guide*, 2-3 (2019).

[48] *Id.*