OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need: Examiner Reliability Study: Black and White Box Studies on Bloodstain Pattern Analysts

Keyword(s): Bloodstains, Bloodstain Patterns, Conclusions, Classification, Analysis, Variability, Accuracy, Error

Submitting subcommittee(s): Bloodstain Pattern Analysis **Date Approved:** 1/5/17

(If SAC review identifies additional subcommittees, add them to the box above.)

Background Information:

1. Description of research need:

Evaluate the variability of results provided by practicing bloodstain pattern analysts when making pattern observations, pattern classifications and reconstruction of test samples. Additionally, evaluate the variability of results provided by practicing bloodstain pattern analysts when conducting classifications of bloodstain pattern test samples. The research outcomes should do some or all of the following: (1.) Quantify intra-analyst and inter-analyst variability as a function of the quality/quantity of the evidence provided, (2.) Quantify intra-analyst and inter-analyst variability as a function of the test taker's education and discipline-specific training and experience, (3.) Identify aspects of the evaluation and classification process and evidence that are sources of consistency in reporting conclusions, (4.) Identify aspects of the evaluation and classification process and evidence that are sources of variability in reporting conclusions, (5.) Elucidate the process by which analysts observe, classify and reconstruct bloodstain patterns (e.g., quality, sufficiency, etc.). Note: Practitioner involvement in providing subject matter expertise during the planning phase of this research is highly encouraged in order to ensure that the research outcomes have applicability to casework, and the test samples are as realistic as possible under the research constraints.

2. Key bibliographic references relating to this research need:

Arthur, RM, Cockerton, S.L., de Bruin, KG, and Taylor, MC, *A novel, element-based approach for the objective classification of bloodstain patterns*, Forensic Sci Int, 2015: p.220-228.

Laber TL, Taylor MC, Kish PE. *The Reliability of Current Methods of Sequencing Bloodstain Patterns*. The Journal of BPA. 2014;30(1):10.

Laber TL, Kish PE, Taylor MC, Owen GW, Osborne N, and Curran J *Reliability Assessment of Current Methods in Bloodstain Pattern Analysis*: NIJ; 2014, Document Number 247180.

Osborne, NKP, Taylor, MC, and Zajac, R, *Exploring the role of contextual information in bloodstain pattern analysis: A qualitative approach*, Forensic Sci Int, 2016: p. 1-8.

Osborne, NKP, Taylor, MC, Healey, M and Zajac, R, *Bloodstain pattern classification: Accuracy, effect of contextual information and the role of analysts characteristics*, Science and Justice, 2016; 56(2): 123-128.

Taylor, MC, Laber, TL, Kish, PE, Owens, G, and Osborne, NKP, *The reliability of pattern classification in bloodstain pattern analysis, Part I: Bloodstain patterns on rigid non-absorbent surfaces*, J Forensic Sci, 2016: doi:10.1111/1556-4029.13091.

Additional relevant research is provided in the ADDENDUM.

3a. In what ways would the research results improve current laboratory capabilities?

The results of this research would be considered by the bloodstain pattern analysis community, laboratories and accrediting bodies in order to implement necessary changes to the methods, standard operating procedures, training programs and other quality assurance practices to reduce analyst error and minimize intra- and inter-analyst variation in reporting. The findings will facilitate discussions between analysts on disputed patterns.

3b. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

A white box study will generate insight into the cognitive process that underlies the analysis of bloodstain patterns. The white and black box studies will consider factors to include: human factors, cognitive factors, the quality of the evidence; visible characteristics of the bloodstains (quality, quantity, clarity, complexity, extent of bloodstain pattern, bloodstain number, size and distribution); the examiner's education, training and experience; examiner certification and laboratory accreditation; and peer review.

3c. In what ways would the research results improve services to the criminal justice system?

The research results will identify the factors that influence the analyst's ability to analyze bloodstain evidence and accurately interpret their findings. Further, the results will be valuable in promoting transparency, objectivity, and the communication between experts and laypersons, particularly within the criminal justice system. This research will provide the criminal justice system an assessment of the reliability of bloodstain analyses and the weight that can be given to these findings.

4. Status assessment (I, II, III, or IV): I

	Major gap in current knowledge	Minor gap in current knowledge
No or limited current research is being conducted	I	III
Existing current research is being conducted	II	IV

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.

Approvals:

Subcommittee	Approval date:	
(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)		

SAC				
1. Does the SAC agree with the research need?	Yes		No	
2. Does the SAC agree with the status assessment?	Yes		No	
If no, what is the status assessment of the SAC:				
Approval date:	1/5/17			
(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)				

Completed Research Regarding
The Accuracy and Reliability of Bloodstain Pattern Analysis

OSAC BPA Research Task Group November 2016

1. Behrooz, N. *Bloodstain pattern analysis of determination of point of* origin (BSc dissertation), Department of Mechanical and Industrial Engineering, University of Toronto, 2009.
2. Buck, U., B. Kneubeuhl, S. Nather, N. Albertini, L. Schmidt, and M Thali. *3D Bloodstain Pattern Analysis: Ballistic Reconstruction of the Trajectories of Blood Drops and Determination of the Centres of Origin of the Bloodstains*, FSI, 206 (2011): 22-28.
3. Camana, Francesco. *Determining the Area of Convergence in Bloodstain Pattern Analysis: A Probabilistic Approach*, FSI 231, no. 1-3 (2013): 131-36.
4. Carter, A.L. and Podworny, E.J., *Bloodstain pattern analysis with a scientific calculator*, Journal of the Canadian Society of Forensic Science 24, no. 1 (1991): 37-42.
5. Carter, A.L., *The Directional Analysis of Bloodstain Patterns: Theory and Experimental Validation*. Journal of the Canadian Society of Forensic Science, 2001. 34(4): p. 173-189.
6. Carter, A.L., *Further Validation of the BackTrack TM Computer Program for Bloodstain Pattern Analysis - Precision and Accuracy*. International Association of Bloodstain Pattern Analysts News, 2005. 21(3): p. 15-22.
7. Carter, A.L., et al., *Validation of the BackTrack™ Suite of Programs for Bloodstain Pattern Analysis.* Journal of Forensic Identification, 2006. **56**(2): p. 242-254.
8. Castello, A., M. Alvarez, and F. Verdú. *Accuracy, Reliability, and Safety of Luminol in Bloodstain Investigation*. Journal of the Canadian Society of Forensic Science 35, no. 3 (2002): 113-21.
9. Connolly, C., M. Illes, and J. Fraser. *Affect of Impact Angle Variations on Area of Origin Determination in Bloodstain Pattern Analysis*. *FSI* 223, no. 1-3 (2012): 233-40.
10. de Bruin, K.G., R.D. Stoel, and J.C. Limborgh, *Improving the point of origin determination in bloodstain pattern analysis.* J Forensic Sci, 2011. **56**(6): p. 1476-82.
11. Hakim, Nashad, and Eugene Liscio. *Calculating Point of Origin of Blood Spatter Using Laser Scanning Technology*, JFS 60, no. 2 (2015): 409-17.
12. Hulse-Smith, L., and M. Illes. *A Blind Trial Evaluation of a Crime Scene Methodology for Deducting Impact Velocity and Droplet Size from Circular Bloodstains*, JFS 52, no. 1 (2007): 65-69.
13. Illes, M.B. and Boue, M. *Investigation of a model for stain selection in bloodstain pattern analysis*. Canadian Society of Forensic Science 44, no. 1 (2011):1-12.
14. Illes, M.B., et al., *Use of the BackTrack™ Computer Program for Bloodstain Pattern Analysis of Stains from Downward-Moving Drops.* Journal of the Canadian Society of Forensic Science, 2005. **38**(4): p. 213-218.
15. Illes, M. and Boue, M., *Robust estimation for area of origin in bloodstain pattern analysis via directional analysis.* Forensic Sci Int, 2013. **226**(1-3): p. 223-9.
16. Joris, P., et al., *Hemovision: An Automated and Virtual Approach to Bloodstain Pattern Analysis,* FSI 251, (2015): 116-23.
17. Laber TL, Taylor MC, Kish PE. *The Reliability of Current Methods of Sequencing Bloodstain Patterns*. The Journal of Bloodstain Pattern Analysis. 2014;30(1):10.
18. Laber TL, Kish PE, Taylor MC, Owen GW, Osborne N, Curran J. *Reliability Assessment of Current Methods in Bloodstain Pattern Analysis*: National Institute of Justice; 2014, Document Number 247180.
19. Larkin, Bethany A. J., and Craig E. Banks. *Preliminary Study on the Effect of Heated Surfaces Upon Bloodstain Pattern Analysis.* JFS 58, no. 5 (2013): 1289-96.
20. Laturnus, P., *Measurement Survey*. International Association of Bloodstain Pattern Analysts News, 1994. 10(3): p. 14-32

21. Maloney, A., et al., *One sided impact spatter and area-of-origin calculations* Journal of Forensic Identification, 2011. **61**(2): p. 123-135.
22. Meneses, B.N., P.E. Kish, and B.J. Gestring, A Preliminary Study of the Error Rate Associated with Bloodstain Pattern Analysis, presented at 61st Annual Meeting of the American Academy of Forensic Sciences. 2009: Denver, CO. In preparation.
23. Osborne, N.K.P., Taylor, M.C., and Zajac, R., *Exploring the role of contextual information in bloodstain pattern analysis: A qualitative approach*, FSI, 2016: p. 1-8.
24. Osborne, N.K.P., Taylor, M.C., Healey, M. and Zajac, R., *Bloodstain pattern classification: Accuracy, effect of contextual information and the role of analysts characteristics*, Science and Justice, 2016: p.
25. Reynolds, M. and Raymond, M.A., *New bloodstain measurement process using Microsoft Excel 2003 Autoshapes*, JFI 58, no. 4 (2008): 453-468.
26. Reynolds, M. et al., *Bloodstain measurement using computer-fitted theoretical ellipses: A study in accuracy and precision*, JFI 58, no. 4 (2008): 469-484.
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28. Rowe, W.F. *Errors in the determination of the point of origin of bloodstains*, FSI 161, no. 1: 47-51
29. Sant, S. P., and Fairgrieve, S.I.. *Exsanguinated Blood Volume Estimation Using Fractal Analysis of Digital Images,* JFS 57, no. 3 (2012): 610-7.
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