

ADDENDUM

Research questions regarding the interaction of blood and fabrics/textiles

OSAC Bloodstain Pattern Analysis Subcommittee

January 29, 2016

Introduction

This document serves as an addendum to the OSAC Research Needs Assessment Form entitled “*Interaction of Blood and Fabrics*” approved by the Bloodstain Pattern Analysis Subcommittee on January 29, 2016. The BPA Subcommittee is of the opinion this addendum provides additional details not captured in said form.

This document proposes research topics that will provide valuable scientific data to underpin the interpretation of bloodstains and bloodstain patterns on fabrics, in particular clothing, and other textiles. The topics proposed represent areas where underpinning science is limited; therefore, further research into how fabric/textile properties may influence bloodstain formation, analysis and resulting interpretation should not be restricted to these proposed topics.

Current limited research indicates variability in the way blood interacts with different fabrics and other textiles, affecting resultant bloodstain appearance. The research thus far indicates the resultant bloodstain appearance is affected by:

1. Fiber type (e.g. synthetic or natural),
2. Fiber properties (e.g. absorbent v non-absorbent),
3. Fiber construction (e.g. filament or staple),
4. Yarn construction (e.g. twisted or non-twisted yarns),
5. Fabric construction (e.g. woven or knitted),
6. Fabric treatments (e.g. water-proofing).

What is the potential benefit for the Bloodstain Pattern Analysis discipline?

Bloodstain appearance may be profoundly affected by the interaction of blood and the fabric/textile it has been deposited on, which can impact the ability of the analyst to accurately identify the mechanism that created the bloodstain or bloodstain pattern. Accurate interpretations are vital for true outcomes.

What is the problem?

1. Blood ‘behaves’ differently on porous fabrics/textiles than it does on non-porous surfaces.
2. The interaction between blood and fabrics/textiles appears to be complex and is not well understood.

Research Questions regarding the interaction of blood and fabrics
Addendum to: Interaction of Blood and Fabrics Research Needs Assessment Form
OSAC BPA Subcommittee January 29, 2016

3. Great variability exists in the properties of fabrics/textiles, and this variability can potentially influence the appearance of resultant bloodstains.
4. The relative importance of fabric/textile properties that significantly influence bloodstain formation and ultimately the interpretation of those bloodstains remains unknown.
5. Given this variability and complexity, straightforward answers to the research questions may not be easily obtained.

What are the research questions?

1. What factors affect the way blood interacts when it is deposited on fabrics/textiles? Questions to be considered for investigation include:
 - a. How does fabric/textile type influence the resulting bloodstain(s)?
 - i. What influence does construction have, e.g., weave, knit, texture, porosity, pigment/dye, etc. have on bloodstain formation and appearance?
 - ii. What influence do yarn properties, e.g., manmade or synthetic, twist, thickness, absorbency, wettability and wicking properties, etc. have on bloodstain formation and appearance?
 - b. How does the condition of the fabric/textile influence appearance of and the ability to interpret the bloodstain(s)?
 - i. What influence do fabric/textile treatments, e.g., stain resistant, fire resistant, water-proofing, fabric softener, starch, dry cleaned, ironing, UV protection, etc. have on bloodstain formation and appearance?
 - ii. What influence does moisture content of a fabric/textile, e.g., sweat, water, wet versus dry and other liquids, etc. have on bloodstain formation and appearance?
 - iii. What influence does washing, e.g., type of wash (hand, machine, dry clean) and number of washes, have on bloodstain formation and appearance?
 - iv. What influence does fabric history, e.g., fabric age, wear and tear, presence of dirt and/or grease, etc. have on bloodstain formation and appearance?
 - c. How do blood droplet volume, blood droplet velocity, kinetic energy, and angle of impact influence resulting bloodstain patterns?
 - d. How do blood volume, transfer pressure and movement influence resulting bloodstain patterns?
 - e. How does the presence of an underlying layer influence the resulting bloodstain(s) observed on the outer layer?
 - i. What influence does the amount of stretch/tension in the fabric and/or underlying layer have on bloodstain formation and appearance?
 - f. How does the wearer's motion/activity/folding of the fabric influence the resulting bloodstain(s)?

- i. Does area of origin apply to fabrics, in particular worn clothing, and other textiles?
2. Is there a way to reliably distinguish between spatter and transfer stains when conducting bloodstain pattern analysis on fabrics/textiles? Questions to be considered for investigation include:
 - a. What bloodstain characteristics typically define transfer stains and do they apply to fabrics/textiles?
 - b. What bloodstain characteristics typically define spatter stains and do they apply to fabrics/textiles?
 - c. What bloodstain characteristics can be used to distinguish between transfer and spatter stains on fabrics/textiles?
 - i. How does the kinetic energy of a spatter droplet affect the subsequent spreading of the resulting bloodstain? Does it do so in a way that may be used to identify the origin as a spatter rather than transfer?
 - d. What fabric/textile variables/properties influence the ability to interpret a bloodstain as spatter or transfer?
 - e. How do fabric/textile variables influence the appearance of transfer stains when those stains are caused by other bloodstained fabrics/textiles?
 - f. Is the ability to distinguish between transfer and spatter stains more reliable on some fabric/textile types than others?
3. What factors affect the drying of bloodstains on fabrics/textiles? Questions to be considered for investigation include:
 - a. What fabric/textile properties influence bloodstain drying time?
 - b. What effect does blood/blood droplet volume have on bloodstain drying time?
 - c. If the fabric is being worn at the time of blood deposition, what effect does the continued wearing of that fabric have on drying time?
4. Is there a way to reliably determine the age of a bloodstain deposited on a fabric/textile? Questions to be considered for investigation include:
 - a. How does the appearance of a bloodstain on fabrics/textiles change over time?
 - i. What fabric/textile properties influence the change in the appearance of the bloodstain as it ages?
 - ii. What environmental factors influence the change in the appearance of the bloodstain as it ages?
 - b. Can fabric/textile properties influence the clotting process?
 - i. Which fabric/textiles properties influence the clotting process and in what way?