Photo Documentation and the Medical-Forensic Examination

Written by Valerie Sievers & Diana Faugno

If There is No Picture, Was There Really Injury?

ANYONE WHO REMEMBERS watching the movie *My Cousin Vinny* (Lynn 1992) knows how a photograph might provide definitive findings during a trial. In the film, an inexperienced attorney, Vincent "Vinny" Gambini travels to a small southern town with his fiancée, Mona Lisa Vito, to represent his cousin in a murder case. Mona Lisa's continuous picture taking of the surroundings of the community with an inexpensive pocket camera causes frustration throughout the film, but eventually produces a photo that holds the key to the murder case.

Recently, on an organization listserv, several questions were posted regarding the utility and necessity of photo-documentation as part of a medical forensic exam for patients who have experienced violence, specifically photo-documentation of genital anatomy and genital injuries. Rationale for omitting or limiting genital photos

included: “I didn’t see any injury when I observed the patient’s genital region,” “The victim advocate suggested photos of the genital region would be re-traumatizing,” and “I’m not familiar with the camera system so I don’t use it.”

The use of photography in health care is referred to in the literature by several terms, including clinical photography, medical photography, medical-legal photography, and forensic photo-documentation. Photo-documentation in health care has been widely used in a variety of clinical practice areas including dermatology, wound and burn care, surgery, gynecology, pediatrics, emergency medicine, clinical education, and research. Reasons for using a camera to address the health-care needs of patients seen in an acute care setting like an emergency department include:

1. Record and document injuries and, potentially, evidence that cannot be preserved indefinitely or may be altered by treatment or repair
2. Provide a future aid to memory
3. Document features and details that may not be important for purposes of care and treatment (e.g., condition of clothing worn by the patient)
4. Provide documentation of injuries or conditions, and to record appearance both before and after medical interventions
5. Record the condition of evidence or injuries at the time of the examination
6. Document normal findings or absence of injuries
7. Document wound-healing progress in follow-up examinations
8. Provide a visual supplement to the medical record
9. Aid in teaching, peer review, and quality improvement
10. Minimize bias
11. Digital images can be stored indefinitely
12. Images can be reviewed by forensic professionals prior to court proceedings (Besant-Matthews & Smock 2001, Primeau & Sheridan 2013)

In the last several decades, photo-documentation in the care of patients affected by sexual abuse and assault has become standard practice and utilized by forensic-nurse examiners and child-abuse pediatricians to document both body surface and anogenital injuries.

The practice of forensic nursing involves numerous areas of specialization. The key to excellent practice in these varied areas is proper and complete documentation. According to Speck & Faugno (2013), complete and accurate identification of anatomy, of injury, as well as documentation of genital injuries after sexual assault are three of the most important forensic functions of the forensic nurse examiner in sexual assault care.

When the SANE/forensic-nurse examiner uses photography consistently in the evaluation of patients affected by violence—for example, taking photographs of all patients, whether injured or normal—credibility of the documentation improves and challenges of bias (e.g., denial of important information to the criminal justice processes) are minimized. However, if the forensic-nurse examiner determines that there is no injury or has a policy to not photograph normal genitalia, or deletes “bad” photographs, the credibility of the forensic nurse and the documentation is undermined and the forensic nurse examiner and the medical record is open to challenges in criminal justice proceedings (Ernst et al. 2011).

Whenever documentation of physical characteristics, a pattern, or other physical evidence is required, photography should be used to supplement and enhance other forms of documentation (Zercie & Penders 2013).

Photographs are demonstrative evidence. Demonstrative evidence serves to illustrate,

demonstrate, or help to explain oral testimony. Photographs are not likely to be admitted as evidence if there is no reference to images in the medical-forensic exam record, and they may not be admitted as evidence if the medical forensic exam record does not include narrative and diagrammatic documentation of specific injuries. The photographs or digital images and the medical-forensic record supplement and corroborate each other. Photography is a tool that can serve to amplify nursing documentation (Pasqualone 2011).

There are currently several photo-documentation protocols available for use in the clinical arena which focus on the comprehensive process of photography of body surface injuries, injuries in older adults, or injuries associated with non-fatal strangulation (Faugno et al. 2020; Bloemen et al. (n.d.), SDFI Telemedicine 2020). At present, there is not a standardized protocol that outlines the detailed anogenital photo-documentation process in a patient who has been sexually assaulted or abused. The authors intend to propose a standardized approach to anogenital photography as part of the medical forensic exam for the adult or adolescent patient who has been sexually assaulted or abused and develop a photographic protocol for forensic health-care professionals.

Following a trauma-centered approach to the patient as part of the medical forensic exam will include obtaining both written and verbal consents to photograph, ensuring patient privacy and dignity, and communicating about the exam and photographic process. Appropriate patient identification should include using a label or book-end cards with the patient's identifying demographic information at the beginning and end of the series of photographs. The next steps in comprehensive anogenital photo-documentation should include:

1) An "orientation" photograph of the vulva that depicts the entire region from the mons to the anal area. This photo should be done before any cleaning, swabbing or manipulation of the genital tissue.

2) Sequential photos of the vulva in two to three sections. This might also include several images at varying levels of magnification or distance. Photos should include both labia majora and minora, and the crease between the majora and minora.

3) A focused photo of the region of the posterior fourchette and fossa navicularis (in adolescents). This is the area where subtle injury is often seen, and it should be ***photographed prior to rigorous separation and traction techniques, application of a cell stain as Toluidine Blue, or the insertion of a speculum.***

4) Applying labial separation and traction, a photo of the clitoris and clitoral hood.

5) A photo of the urethra and periurethral area.

6) A photo of the hymen tissue. In the **child-bearing patient with estrogenized hymen tissue**, an obstetric swab or air-filled urinary catheter balloon should be used to evaluate the circumference of the hymen tissue. This step is typically done **after** the collection of any specimens.

7) A photo of the fossa navicularis.

8) A photo of the posterior fourchette.

9) A photo of the anus and perianal area.

10) During speculum insertion, photos should be taken of the vaginal walls bilaterally, and the cervix and cervical os.

Photo-documentation of genital injury taken with a colposcope and attached digital camera should include several images at varying levels of magnification, while a digital camera and macro lens can be used to capture images at mid-distance, close-up, and extreme close-up photos if needed.

Frequently, novice forensic clinicians will ask about the specific number or quantity of digital images that should be taken as part of the sexual assault medical forensic exam. A good rule of thumb is to take as many pictures as needed to best represent anatomic findings, as well as any findings of injury. This might mean that the forensic nurse examiner is taking 12–30

photos or more, depending on patient presentation. Another good rule of thumb is to never delete a photo, even if it is out of focus or pixelated. Photographs should not be manipulated, and if photographic software is used to annotate or describe an image, the original image should be saved, and for each annotated image there should be an embedded record of who captured the photograph and annotated the image.

The patient who is affected by violence always has the option to decline having photos taken of body-surface injury or anogenital findings. An important component of the responsibilities of the forensic nurse examiner is not only to offer that option to patients as part of a trauma-informed response, but also to explain to the patient how the photos will be used and how they might be helpful for diagnosis and potentially in the criminal-justice arena. Since anogenital photos can be perceived to be graphic or inflammatory, and there is typically no need for juries to review anogenital photos, the forensic nurse can review photos prior to testimony and annotate a black and white diagram of male or female genitalia while objectively describing the anatomy and identified injury or normal findings. This option should be reviewed in advance with the attorney.

Quality review of all case photographs and reports is important for learning and improving patient care. Ernst & Speck (2011) describe seven attributes to consider when evaluating the quality and consistency of a photograph. These attributes are highlighted in the chart below.

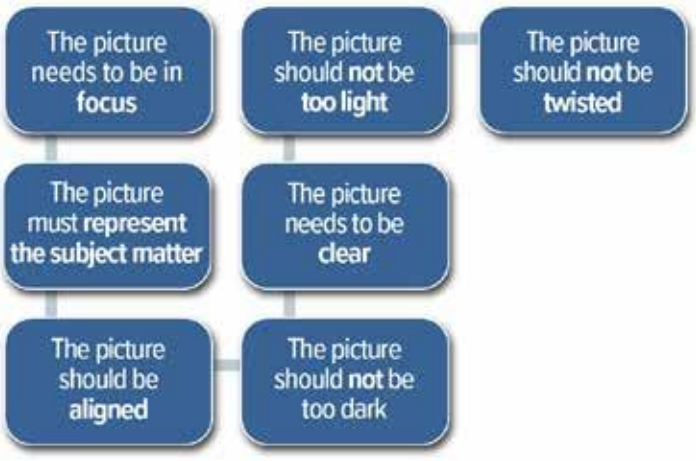

Photo-documentation is an accepted standard of care and essential skill for forensic nurses responding to patients affected by trauma and violence. Forensic nurses should anticipate exposure to evidence-based education that includes the essentials of photo-documentation. The SANE Program Development and Operational Guide (2016) suggests that photo-documentation creates a mechanism for peer review of exam findings. It is the only way that a nurse's evaluation of an injury can be peer reviewed, which is an essential part of SANE/forensic nurse examiner practice. Clinical policies for photo-documentation within forensic-nursing practice programs should include a standardized approach to anogenital photography, expert review of photos to support quality improvement, and a detailed process for storage and release of digital images.

In summary, photo-documentation and imaging equipment has continued to evolve. Photographic images can be invaluable and will continue to impact forensic nursing practice. Keep it simple, know your equipment, follow your procedures and clinical guidelines, and remember that accurate photo-documentation is a standard of forensic care. The use of a comprehensive photography protocol during the medical forensic exam will positively affect health-care services provided to those affected by crime and violence while serving the interests of justice.

Case Example

You are called to testify in a domestic violence/sexual assault case. As the forensic nurse examiner, you saw the patient two years ago and recall that she had sustained multiple body-surface and genital injuries. In addition to providing the medical-forensic exam, you took photographs of her various injuries.

While on the stand, you are shown the photos and are asked to describe the anatomy and the various injuries to the jury.

It is easy for the jurors to see the injuries and consider the demonstrative evidence, based on your description of the injuries, as well as your ability to identify the specific injures on the photograph that is displayed for

the jury to see.

Outcome: Guilty on three counts. Sentence, 12 years.

About the Authors

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References

Besant-Matthews, P., and W. S. Smock. 2001. Forensic photography in the emergency department. In J. S. Olshaker, M. C. Jackson & W. S. Smock (Eds.), Forensic Emergency Medicine pp. 257–282. Philadelphia: Lippincott Williams & Wilkins.

Bloemen, E. M., T. Rosen, J. A. Cline, V. LoFaso, S. Clark, M. R. Mulcare, M. E. Stern, R. Mysliwiec, N. Flomenbaum, M. S. Lachs, and S. Hargarten. (n.d.) Comprehensive photography protocol general & specific guidelines for photographing injuries in older adults. University Hospital of Columbia & Cornell. Retrieved: http://nyceac.com/wpcontent/uploads/2012/02/Photography-Protocol.pdf

Ernst, E., P. M. Speck, and J. J. Fitzpatrick. 2011. Evaluation of image quality of digital photo documentation of female genital injuries following sexual assault. Journal of Forensic Nursing. 7:182–189.

Ernst, E., P. Speck, and J. J. Fitzpatrick. 2011. Usefulness: forensic photo documentation after sexual assault. Advanced Emergency Nursing Journal. 33(1):29–38.

Faugno, D., D. R. Bowman, V. Sievers, T. Ingram-Jones, C. Baldwin-Johnson, B. Rodarte, and B. Smock. 2020. Pediatric non-fatal strangulation photo-documentation protocol. Boulder City, NV: SDFI-TeleMedicine, LLC. Retrieved: https://www.sdfi.com/downloads/SDFI_Pediatric_Non-Fatal_Strangulation_Protocol.pdf

Lynn, J. (Director). 1992. My Cousin Vinny [Film]. 20th Century Fox.

Office for Victims of Crime. 2016. SANE program development & operation guide. Retrieved https://www.ovcttac.gov/saneguide/identifying-essential-components-of-a-sane-program/photo-documentation/

Pasqualone, G. A. 2011. Forensic photography. In V. A. Lynch and J. Barber Duval (Eds.) Forensic nursing science (2nd ed.). pp 61–79. St. Louis: Elsevier Mosby.

Primeau, A., and D. J. Sheridan. 2013. Evidence: Forensic nursing care in the emergency & acute care departments. In R. Constantino, P. A. Crane, S. E. Young, (Eds.) Forensic nursing: Evidence-based principles and practice. pp 320–321. Philadelphia: F.A. Davis.

SDFI Telemedicine. 2020. SDFI forensic photography photo-documentation protocol. Boulder City, NV: SDFI-TeleMedicine, LLC. Retrieved from www.sdfi.com

Speck, P. M., and D. F. Faugno. 2013. Interpersonal violence: Intimate partner child and elder violence and the three levels of prevention. In R. E. Constantino, P. A. Crane, and S. E. Young (Eds.) Forensic nursing: Evidence based principles and practice. pp 117–135. Philadelphia: F.A. Davis Company.

Zercie, K. B, and P. Penders. 2013. Photography in forensic nursing. In R. M. Hammer, B. Moynihan & E. M. Pagliaro (Eds.) Forensic nursing: A handbook for practice. pp 483–489. Burlington, MA: Jones & Bartlett.

PRODUCT REVIEW

Crime Scene Assistant
Smartphone App

Written by Maria C. Pettolina

Crime Scene Assistant

Apple ($6.99) I Android ($7.49)

DEVELOPED BY EXPERIENCED crime scene investigators, Crime Scene Assistant is a smartphone app developed to be a pocket quick-reference guide for first responders to help maintain the integrity of a crime scene. According to the developers, "The app is a concept that has been brought to life as a result of personal field experience, and an acknowledgement that forensic awareness on the frontline is imperative."

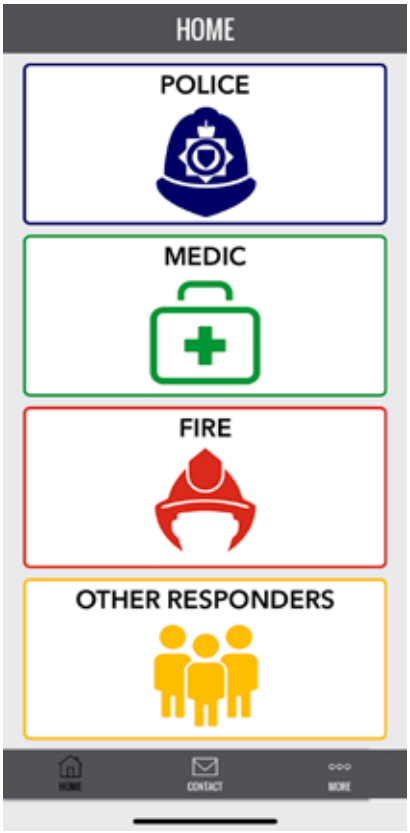
The developers with Crime Scene Assist Ltd. intend for the app to be useful to all front-line responders, including police officers, fire-department personnel, medics, fraud investigators, and security officers. The app provides guidance in a simple, offline format that can be accessed at any time, right on the user's smartphone.

In addition, a new licensed version of the app has been developed that allows educators and employers to purchase the app in bulk (at a discounted rate) for the education of students, new recruits, and employees. Crime Scene Assist Ltd. is also working to develop online training courses that build on and support the knowledgebase in the app.

Quick Impressions

Overall, I found this application useful as a basic refresher of "what to do" on scene, but not as a guide on "how to do it". I think this application would serve as a helpful resource to accompany a training program for students and new first responders. For example, this would be incredibly helpful for students or new trainees to use as a checklist when working a mock crime scene to help build muscle memory.

I do not find it overly helpful, or feasible, for crime scene investigators (CSIs) to use on scene. But, in reviewing this application, it does not present itself for use by CSIs, but instead for other first responders discussed below.



The Home screen in Crime Scene Assist

A Closer Look

The user is expected to have baseline knowledge before using the application. When the application is downloaded, the user needs to acknowledge a "Basic Awareness of Forensics". The application reminds the user that the information is used to support as an aide-mémoir and reference tool, not an alternative for training. It also requires the user to sign off on a liability statement.

The application was easy to navigate with simple options. There were three main options to select: a HOME button, a CONTACT button, and a MORE button that allows the user to view the terms and conditions. The user will mostly function from the HOME button.

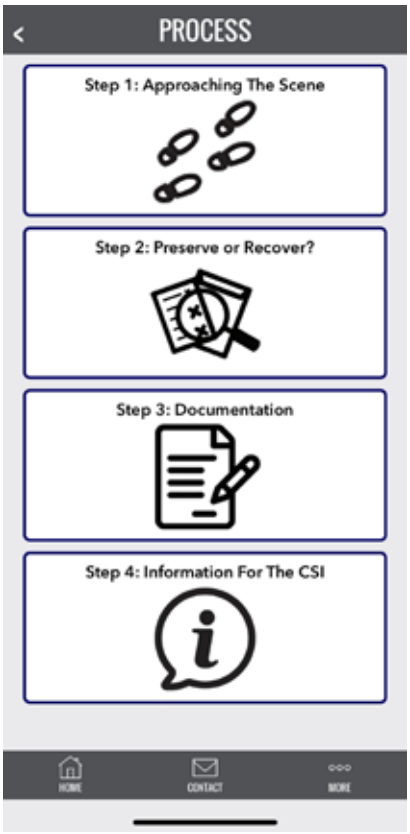
Once the HOME button is selected, four main categories populate: Police, Medic, Fire, and Other Responders. The application's tagline reads "Making Forensic Awareness Second Nature for First Responders". My initial expectation was to see a CSI category and perhaps some much-needed reminders on how to document bloodstains or bullet holes (hence the Crime Scene Assistant name). These are areas of forensics we as CSIs are trained on, but since we sometimes have the luxury of slowing down, the application could serve as a friendly reminder. I will admit I have absolutely googled how to mix chemicals or mix casting material while on a crime scene. But… this is not a CSI application.

I was impressed with the organization of the steps and the information contained in the checklists. It is clear that a team of forensic experts developed this application. The creators of this application undeniably have experience in forensics and CSI. As a CSI and educator, I want to have confidence in the expertise of the creators when I do recommend this to students and other first responders.

The website states it is developed in the United Kingdom, so I understand some titles and terms may differ from what we are accustomed to in the United

States. There are also terms and acronyms on the application that I was not immediately familiar with.

To give you a better understanding of the usefulness of the application, I will offer you a visual on how the application functions. Once you select a category—for example, Police—four steps populate. Although the steps for each category are similar, they do differ by what type of first responder you select. For example, if you select the Medic option, there is an additional step of Sexual Offenses. In this step, it allows users in the UK to find a hospital and follow a flow chart for these special cases.



Process steps for the Police option.

Applications for the App

Again, I found this application to be helpful as a resource for a training program, but I do not find it feasible as far as using it on a crime scene. Police, fire, medics, and other first responders often are called to hectic and high-stress events. I do not find it practical for the first responder to open this application and start running down a checklist during an active scene. If the first responder needs to do that, they should not be on the crime scene without a trainer or supervision.

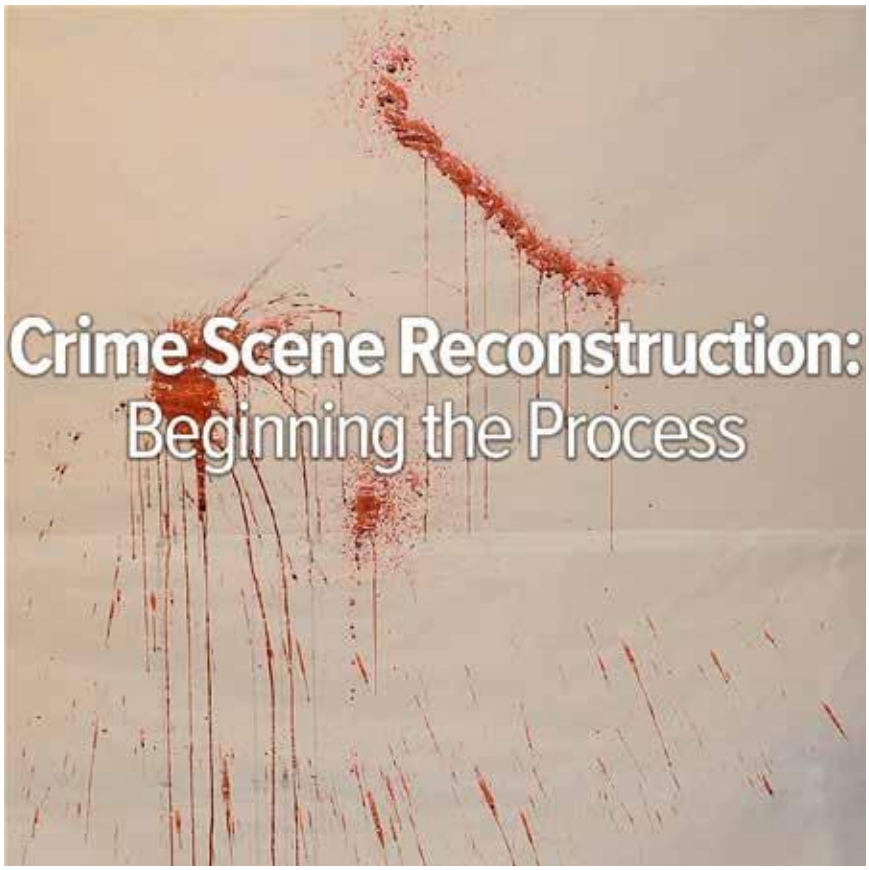
If the application is incorporated into a training program, the first responder would be familiar with the information and could review the checklists after the crime scene to see if they missed a checkbox, or to consider if they need future additional training.

I did very much appreciate the "Information for the CSI" step that was on the Police checklist. This checklist was provided for the police officer as a way to prepare for information that the CSI will request in order to efficiently process a crime scene. For example, checkboxes include the victim's name, location and review of surveillance cameras, and evidence that could have been moved prior to arrival. This may be useful for the officer to review, when the scene is calm and safe, and when they are waiting on CSI arrival.

Also, while I do feel the application touched on this with the acknowledgment statements, I offer a word of caution: As a user, you would want to ensure that these guidelines do not contradict your policies and procedures. For example, it may not be recommended in some jurisdictions that EMS and Fire collect evidence, yet there are checkboxes for that. So, if you do adopt this application for training purposes and for future use on crime scenes, I would consider your own policies and procedures before accepting recommendations on how to proceed.

About the Author

Maria C. Pettolina, CSCSA, has over a decade of forensic experience and has worked as an investigator and a supervisor in crime scene and property and evidence. She is currently employed as a forensic consultant in Colorado and is a national speaker on emotional wellness for crime scene investigators. She is the owner of Future Focus Forensics, which offers expert training and consultancy services. Pettolina is a doctoral candidate and is published in the field of forensics. For the past seven years, she has been the lead instructor for a forensics program at a university in Colorado. She has over 1,200 hours of specialized forensic training and has been introduced as an expert in numerous criminal trials. She is a Certified Senior Crime Scene Analyst through the International Association for Identification.



Written by Douglas A. Young

THIRTY YEARS AGO, when I began my career in the forensic field, I often wondered how the senior crime scene investigators were able to construct such complicated and sizable cases in a way that seemed so methodically seamless. The enormous amount of evidence and information was neatly compartmentalized and flowed effortlessly as the cases were presented in court. As my career as a CSI progressed and my education, training, and experience expanded, I learned that my early mentors were using a systematic and methodical process that I would later come to know as Crime Scene Reconstruction.

I quickly realized that in order to become an expert in crime scene analysis and reconstruction, my focus on the science required a wider scope. My interest and desire to learn more about the reconstructive process and to immerse myself in the subject only became increasingly intensified. I found myself wanting to reconstruct every scene I investigated—a daunting task to say the least, even for the most experienced crime scene analyst.

In this article, I will attempt to ease your fears of the complications and stresses in reconstruction by sharing some of my experiences and expertise, and by simplifying the information in a way that is beneficial to both new analysts and seasoned CSIs.

Reconstruction of major cases not only demands a systematic and methodical approach, but also bears the requirement of passing judicial muster. One of the judicial questions always asked is, Was the method used scientifically valid? The methodology used in crime scene reconstruction is the Scientific Method. This methodology allows the analyst a systematic, structured approach to analyzing an occurrence by:

- defining a question
- forming hypotheses about an occurrence
- collecting data surrounding the occurrence
- conducting test/experimentation/analysis
- stating a conclusion regarding the occurrence

The Scientific Method helps the reconstructionist be more objective and reduce assumptions and bias. The structured approach allows for maintaining focus and being more effective. As analysts investigate an occurrence, they use the data found within to drive the conclusion and, as they refine the data, the conclusion is refined.

Objective data, evidence, and information drive an investigation from the beginning. An officer's or investigator's education, training, and experience all affect whether they may recognize something as probative within a scene. As reconstructionists, we must ask ourselves how we can help hone an officer's or an investigator's evidence-recognition skill set so that they can gather data in an investigation that results in a final reconstruction product that is the very best that it can be. We must always support our conclusions with evidence, be critical thinkers, and refuse to accept any evidence or conclusion without sufficient proof (Chisum & Turvey 2011).

At the onset of a case, the reconstructionist needs to understand that he or she will be faced with a large volume of information. This information or data may come from the crime scene, forensic reports, photographs, or a myriad of other sources. The task of organizing and filtering this information may seem overwhelming. What is done with all of this objective data? Whenever possible, this information must be placed into a framework that allows for organization and establishment of the event's chronology. While reconstructionists have varying methods for the organization of their thoughts and observations (Post-it notes, 3x5 index cards, dry-erase boards, etc.), it is always important to remember that the goal of reconstruction is the same: breaking down complex problems and information into their component parts.

No matter how this information is organized, one theme rings true—the use of flowcharting. Flowcharting provides the investigation with an organized, concise overview of data points, and helps the investigators, the judge, and the jury understand the data and chronology associated with a specific case.

Crime scene reconstruction requires investigators to "explain complex phenomena in areas where different theoretical laws and sets of causes intersect" (Nordby 1999). The reconstructionist is challenged to answer very complex questions in the face of large amounts of data. To demonstrate the intricacies of this statement, the analogy of assembling a 1,000-piece jigsaw puzzle comes to mind. Each piece of the puzzle is a piece of data. Each piece tells us something about the whole. However, not every piece always tells us something that we need or want to know about the question. We must consider the whole—every single piece of the puzzle—all the while remaining objective. We must also synthesize the incoming information in the pursuit of explaining the questions posed to us.

The contextual component in which these pieces of data are found must also be considered. Context—that is, the circumstances that form the setting for an event and the terms in which it can be fully understood and assessed—is also needed. Each piece of evidence is considered on its own, and then as part of the whole. The reconstructionist must always consider context

when a new piece of evidence or information is discovered. Without context, the importance of the evidence or information cannot be fully understood.

When looking at evidence and information gathered within an investigation, not only is the contextual component important, but the reconstructionist must also look at these items in a holistic, unbiased, and generalist mindset. The reconstructionist should not be invested in the outcome of an investigation, but instead should focus on continually basing investigations and analyses on sound scientific methods and principles. The reconstructionist must recognize that biases exist, and continually guard and fight against them. Peer reviews by qualified reconstructionists and audits of the information assist in safeguarding against these biases and unsupported conclusions.

The observation of bloody drag marks down a hallway provide objective data and evidence that can help reconstruct a scene.

Events that occur within a scene cause change. These changes occur as the result of an actor (who initiated change by their action) and an action (what the actor did) (Benner & Carey 1975). The order of actions can be recognized in three basic relationships. These relationships involve something that precedes an action, something that follows an action, and something that occurs simultaneously with an action. Every event that occurs within a scene is the result of an action and every action has a cause (Gardner & Bevel 2009). It is absolutely necessary that the reconstructionist understands the concept of this cause-and-effect relationship.

The reconstructive process begins when the first call for service in a case is initiated. The first step in the chronological process, which is initiated with this call for service, is known as **absolute chronology**. Examples of absolute chronology would be a time/date stamp on body-camera footage or a 911 call. Absolute chronology deals with specific points of time.

The second chronological process is **relative chronology**. Relative chronology is synonymous with the concept of the sequencing of actions, which sometimes becomes a difficult task. Here's an example of relative chronology: I am punched in the nose, my nose begins to bleed, and it continues to drip onto the floor—creating a drip pattern. As the reconstructionist, relative chronology is used to sequence these actions. The relationships between actions help us to create a sequence:

1. Struck
2. Bleeding
3. Blood impacts floor
4. Pattern created

As a young investigator, I was always told by the senior investigators that I needed to be able to answer the five W and one H questions (who, what, where, when, why, and how). During my career, I have found it a lot harder to answer the why question more times than not. Why is not always answerable, as it goes to a person's reasoning for committing a crime; this question cannot be supported objectively by case evidence and information.

Whatever the assigned role one takes in the investigation of a case, it is imperative to use the following questions to navigate the reconstructive process:

- What is the particular evidence or information?
- What can be learned from the particular evidence or information?
- What relationship to the crime does the

particular evidence, information, or observation have? Is there a functional component to it?

- Can a particular piece of evidence, information, or observation be linked to other pieces?
- Using this particular piece of evidence, information, or observation, is the reconstructionist able to support and or refute a hypothesis of the events?
- Can the evidence, information, or observation be used for purposes of timing and sequencing of the event?

These questions are foundationally strong and help accomplish several reconstruction goals. First, they provide for looking at particular pieces of the whole and asking what can be learned from the particular piece (taking a complex problem and breaking it into its component parts) as well as determining how it relates to the bigger picture. Second, how is it linked to other pieces of information or evidence? Finally, can it be used to sequence the event?

At this point in the process, we have most likely been able to refine our data, information, and observations, and we have provided some answers to the questions listed above. Remember, data drives our conclusions and with refined data comes refined conclusions. By this point in the investigation, it is highly probable that case theories have been developed by all parties to the case. The reconstructionist cannot become invested in the outcome of the investigation. The reconstructionist must follow science, remain objective and impartial, and always base their investigations and analyses on sound scientific methods and principles.

We are now ready to employ the scientific method for each of the investigative questions in the case. As stated earlier, the scientific method provides the analyst with a systematic, structured approach to analyzing an occurrence, while also helping the reconstructionist be more objective, reducing assumptions and bias, maintaining focus, and being more effective.

Below are the steps the analyst would follow for each of the variable/investigative questions in the case.

1) Define the investigative question. Be cautious of broad investigative questions.

2) Collect data to resolve the investigative question. The more refined the data, the more refined the conclusion.

3) Identify variables and posit hypotheses. We are identifying a viable explanation for the investigative question as well as the counter-argument to this viable explanation.

4) Make predictions about what would be found if each hypothesis were true.

5) Test each hypothesis against evidence and information collected in the case. This is done in the form of "if this, then that".

6) Define the conclusion and repeat the process for each variable or investigative question. This is the reconstructionist's opinion as to the best explanation to the investigative question. This opinion is based on data and evidence.

I hope that this article has not only stoked interest in the area of crime scene investigation, which I hold near and dear to my heart, but also an interest in crime scene reconstruction. Additionally, I hope the article serves as a tribute to those scientists and reconstructionists, past and present, who have—through their hard work and sacrifice—provided a collective body of knowledge from which the rest of us may draw from and build upon for years to come.

About the Author

Doug Young began his law enforcement career with the Gibson County Sheriff's Department in southwestern Indiana. While working at the sheriff's office, Young attended Vincennes University, where he majored in Law Enforcement/Criminalistics, graduating cum laude. He began his training as a crime scene technician with the Gibson County Sheriff's Department and held that position from 1991–1998. In December 1998, Young moved to Texas and took a job with the Austin Texas Police Department as a Sr. Crime Scene Specialist. While in Texas, he became certified as a Crime

Scene Investigator through the International Association for Identification.

In November 2002, he took the position of Chief of Police with the Oakland City Police Department in Indiana, where he served until May 2007. That same month, Young moved to Thornton, Colorado where he took a position as a Crime Scene Investigator. In August 2009, he was promoted to Sr. Criminalist and continues to serve in this capacity. Young has lectured both domestically and internationally on various forensic topics and has been qualified as an expert witness in both federal and state courts.

He is a past president of both the Indiana and Rocky Mountain Division of the IAI and is still an active member of both the parent body IAI and the Rocky Mountain Division. Young served as the regional representative for the RMDIAI until 2019. He is a member of the Association for Crime Scene Reconstruction (ACSR) and is currently serving as the president elect for ACSR. Young started the Colorado Forensic Investigators Group (COFIG) and is the owner of Triad Forensics LLC, a small forensic training and consulting business located in Longmont, Colorado.

References

Benner Jr, L., and W. D. Carey. 1975. Can accident investigation tools help crime scene reconstruction. Journal of Safety Research. 7(2).

Chisum, W. J., and B. E. Turvey. 2011. Crime Reconstruction. San Diego, CA: Academic Press.

Gardner, R. M., and T. Bevel. 2009. Practical Crime Scene Analysis and Reconstruction. Boca Raton, FL: CRC Press.

Nordby, J. J. 1999. Dead Reckoning: The Art of Forensic Detection. Boca Raton, FL: CRC Press

Hemp or Marijuana? NIST to Help Labs Achieve Accurate THC Measurements

Written by Rich Press

THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) has launched a program to help laboratories accurately measure THC and other compounds in cannabis products, including hemp and marijuana. The program aims to increase accuracy in product labeling and help forensic laboratories distinguish between hemp, which is legal in all states, and marijuana, which is not.

The Cannabis Quality Assurance Program (CannaQAP) is an interlaboratory study that will involve several exercises. In the first exercise, NIST will send hemp oil samples to participating labs, which will then measure the concentration of various compounds and report back to NIST. Future exercises will involve plant material, edibles, and other samples with complex matrices.

The Agriculture Improvement Act of 2018, also called the 2018 Farm Bill, legalized any cannabis material with a THC concentration below 0.3%. Below that number, it's hemp. At

or above that number, it's marijuana, and illegal in many states and by federal law. A farmer's crop can be destroyed based on that number, and interstate shipments can be seized.

"But many labs have limited experience making the type of quantitative measurement that the law now requires," said NIST research chemist Brent Wilson.

Before the 2018 law, most crime labs determined if something was marijuana using the Duquenois-Levine test, a preliminary colorimetric test that indicates whether THC-like compounds are present, as well as a visual or microscopic analysis of plant features. The presence of THC could also be confirmed using GC-MS. However, while these tests indicate whether THC is present in the sample, they do not provide quantitative results. The law now requires concentration measurements and producing accurate and reliable numbers at levels as low as 0.3% can be a particular challenge.

"Many labs have limited experience making the type of quantitative measurement that the law now requires."

—Brent Wilson
NIST research chemist

Here's how CannaQAP will work. In the first round of exercises, NIST will send hemp oil samples—all with the same, very carefully measured concentrations of THC, CBD, and 15 other cannabinoid compounds—to participating labs. Those labs won't be told the concentrations of those compounds but will measure them and send their results back to NIST, along with information about the methods they used to do the analysis.

After collecting responses, NIST will publish the measurements the labs obtained. That data will be anonymized so that the names of the individual labs are not revealed. However, the results will show how much variability there is between labs. Also, NIST will publish the correct measurements, so each lab will be able to see how accurate its measurements were and how it performed relative to its peers.

"Anonymity means that labs don't have to worry about how their performance will be viewed," said NIST research chemist Melissa Phillips. "Our goal is to help labs improve, not to call them out."

The NIST researchers will also assess whether some laboratory methods consistently produce better results than others. If so, they can recommend that labs adopt the better-performing methods.

Once that first round of exercises is complete and the data is published, which could take from six months to a year, NIST will run a second round of exercises. "We hope to see a tightening of the numbers the second time around," Wilson said.

NIST is also planning to conduct future exercises with ground hemp and possibly marijuana, as well as edibles and other types of samples with complex matrices. Some of these samples may involve THC levels close to 0.3%, which will help labs determine the reliability of their measurements near this cutoff value.

NIST is also working on a hemp reference material—that is, a material that comes with known, accurate measurement values. Labs will be able to use that material to validate their measurement methods. One reason these measurements vary so much from lab to lab is that, currently, there are no reference materials for cannabis.

"Labs can accurately measure how much sugar is in your orange juice because they have standardized methods and reference materials for that type of product," said Susan Audino, a chemistry consultant and science adviser to the Cannabis Analytical Science Program of the AOAC International, a group that establishes standard methods for laboratory analysis. "But cannabis has been a Schedule I drug since the '70s," she said, referring to the Drug Enforcement Administration's designation for drugs that have the highest potential for abuse.

NIST produces thousands of standard reference materials and has a long history of conducting quality assurance programs for improving measurements. Past programs have helped labs accurately measure compounds in dietary supplements, vitamins in human serum, and environmental contaminants in groundwater.

"Our goal is to support U.S. industries by helping labs achieve high-quality measurements," Phillips said.

About the Author

Rich Press is science writer and public affairs specialist with the National Institute of Standards and Technology (NIST).

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