

Just Technology to Improve Sexual Assault Bruise Detection

Introduction [00:00:01] RTI International's Justice Practice area presents Just Science.

Introduction [00:00:10] Welcome to Just Science, a podcast for justice professionals and anyone interested in learning more about forensic science, innovative technology, current research, and actionable strategies to improve the criminal justice system. In this 2024 Sexual Assault Awareness Month special release episode, Just Science sat down with Doctor Katherine Scafide, Associate Professor and sexual assault response researcher at George Mason University, to discuss how her team is developing methods to improve the visibility of bruises on black and brown skin tones following a sexual assault involving victims of color. During a sexual assault medical forensic exam capturing injuries such as bruises can be crucial for helping bring a case to justice. To address the challenge of bruise visibility on victims with darker skin tones, researchers are developing methods and technological solutions that better detect and capture skin discoloration for certain cases, as well as lead to improved outcomes and promote greater equity for victims of marginalized communities. Listen along as doctor Scafide discusses how her clinical background informs her current sexual assault response research, the importance of consulting clinical practice guidelines before adopting a new technology, and how her work aims to address equity and inclusion in sexual assault response. This episode is funded by the National Institute of Justice's Forensic Technology Center of Excellence. Some content in this podcast may be considered sensitive and may evoke emotional responses, or may not be appropriate for younger audiences. Here's your host, Jason Chute.

Jason Chute [00:01:30] Hello and welcome to Just Science. I'm your host, Jason Chute with the Forensic Technology Center of Excellence, a program of the National Institute of Justice. As you may know, April is Sexual Assault Awareness Month, we will be covering emerging topics in the arena of sexual assault response reform. Today, we'll be discussing improving the detection of bruises on black and brown skin tones as it relates to sexual assault response. To help guide us in today's conversation, I'm joined by our guest, Doctor Katherine Scafide. Welcome, Katherine. It's great to have you here.

Katherine Scafide [00:02:01] Thank you for having me.

Jason Chute [00:02:02] Katherine. Looking at your bio, which is very impressive, your career has diverse paths, which include academia, research, and a sexual assault nurse examiner. Can you tell us a little bit about yourself and how you came upon these multiple paths?

Katherine Scafide [00:02:15] Well, I began my career as a emergency room trauma nurse, and I worked with a lot of victims of violence in the emergency room setting, recognizing the important care that they needed. And I decided to focus my career on forensic nursing. As a forensic nurse examiner, I conducted the sexual assault exams on adults and pediatric victims of acute in addition to intimate partner violence victims. And during this time, I identified some key clinical challenges that needed to be addressed in order to provide the best possible outcomes for these patients. One particular area of concern was the difficulty it was to see injuries on individuals with diverse skin tones, dark skin tones, even medium skin tones. Due to the fact that the pigmentation often made it difficult to see these injuries, and it was very challenging and left me as a clinician feeling fairly helpless in my ability to give these patients the best care I could provide them. And I decided I needed to move on to follow a path that would help solve these problems. And

thus I became a researcher in being able to conduct research that would address these challenges facing victims of violence when they are receiving their medical forensic exam.

Jason Chute [00:03:38] To me, your background provides a unique perspective that bridge, if you will, between research and practice. Could you discuss the significance of this relationship as it pertains to research and practice?

Katherine Scafide [00:03:49] Well, the relationship between clinicians and researchers is essential. Clinicians have the frontline experience working with their patients and identifying relevant and important clinical problems that are affecting the outcomes of their particular patients and in this case, working with victims of violence. And researchers can then partner with clinicians in order to address these important challenges. Essentially, the clinicians identify the problem and the researchers help to evaluate a solution, whether that is to design the methods and constructing the studies, they can provide that expertise to really try to identify solutions that could work within the clinical context that the clinician is able to provide.

Jason Chute [00:04:37] So let's just step back for one minute. And wearing your sexual assault nurse examiner hat, can you briefly walk the audience through a sexual assault forensic exam and trauma informed care?

Katherine Scafide [00:04:46] Well, sure. And I'm glad you bring up trauma informed care, because that is a essential component to conducting a sexual assault medical forensic exam. The goal of the exam. There's actually two goals, but there's really a primary focus on the medical health and well-being and safety of the patient. And the secondary goal is in recognizing, documenting, capturing any evidence that would be relevant for their particular visit with the clinician. So there's those two goals. But ultimately the medical care trumps the forensics care in all situations. So if there is a so we always address the medical needs first. But through that process we ensure that we support the patient's healing and recovery while at the same time minimizing victimization. That is the essential philosophy of trauma informed care. So we always are very careful to, be empathetic and respectful with the patients in assuring their privacy. Ultimately, we want them to feel safe when they're working with forensic clinician. We want to give them the autonomy to make decisions about their care. So a key piece of that is having them provide us informed consent. So explaining the exam, make sure they understand the reasons behind the exam. Make sure they know they have a choice whether or not to have the exam. And that really does empower the patient. We want to make sure they feel a sense of control over their care. And that transparency about what we do during that exam process really helps us build trust and maintain trust with the patient. We want them to feel like they're being heard and believed. We actually start the exam out with conducting a thorough history, including a medical history, just like you would obtain during any doctor's appointment, and then also a history about the incident that brought them to receive, a medical forensic exam. Then when we move forward from conducting that history, we conduct the physical medical exam, which is a head to toe assessment of the patient, followed by some focused assessments on areas of potential injury or potential evidence. The idea is you start with less sensitive areas and then progress until you get to the most sensitive area, ultimately continuing to build that rapport. Another aspect of trauma informed care is to encourage them to be involved in the decision process and essentially collaborate on their care. And then finally, it's really crucial that we try to do as best as we can to minimize re traumatization because doing a sexual assault exam post a sexual assault can be very traumatizing, and they may or may not have already interact with law enforcement, have had to tell their story again and again and again. So we use the skills that I've already

discussed to try to minimize the re traumatization, but we also take into consideration the patient's cultural beliefs, their previous history with trauma, because this may not have been the first incident, and any particular gender norms that they may be used to. So we be very respectful of all these aspects of their care and, integrate it as we conduct the medical forensic exam. After we've collected evidence, we've done the exam, we have the history, we make sure we have good documentation of what we've done and what we've seen and what we've heard. We take, digital images of anything that mostly involves injuries that we happened upon during the exam. And then we assure that the patient receives referrals, medication to prevent sexually transmitted diseases, if that's relevant for them, but the referrals is really key, because they need to be able to have resources to follow up on. And then finally, the evidence we are very careful to store it appropriately. Assure chain of custody is maintained prior to it being released to law enforcement.

Jason Chute [00:08:43] Thank you for that. And I really appreciate you stressing the importance of that trauma informed care. I think we all know that work in the field how important this is, and I can imagine building that empowerment and trust obviously helps with your first goal of putting the patient first. But then can you elaborate a little bit on the second goal? I assume that if you build this empowerment and trust, does it help improve evidence collection?

Katherine Scafide [00:09:07] First of all, a medical forensic exam can be very long. We need to be transparent with the patient about that experience and what the rationales are for the different procedures we want to perform and why it's important, particularly in the area of collecting evidence. And, you know, one thing we try to encourage is have the evidence collected because obviously you lose it if you don't collect it at that time. And what's wonderful is particularly sexual assault, patients who experience that type of victimization have the right to have a forensic medical exam without involving law enforcement. And that is crucial to be able to assure that evidence can be collected as quickly as possible after the event, while the patient is still making up their minds about involving law enforcement. And the transparency is is really key. Explaining to the patient as you do the exam what you're seeing. So many patients are very curious about what you're finding and like to see the images that you collect. Want to hear about the evidence that you're collecting and supporting them, being engaged in that process. Is an essential piece to that trauma informed care process.

Jason Chute [00:10:16] Now, as you mentioned specifically, your research has focused on a particular aspect of forensic medical exam, which is the identification and documentation of bruising. From your perspective can you discuss the importance of detecting bruising when conducting this type of exam?

Katherine Scafide [00:10:31] Well, as I mentioned earlier, bruises are the most common type of soft tissue injury we see amongst victims of violence across the lifespan. The way we see these bruises, the location of them, the description of them, that information can really tell a story about what happened to them based on the mechanisms that cause bruising to occur. So capturing that, those details about those bruises is really important, but also just as important as the history that we get from the patient, because sometimes a history is not available. And so interpreting bruises can be more difficult. So we want to get as much history as possible in order to support our exam. And then that documentation, whether or not it's written documentation or photographic documentation, all of that provides essential evidence as the patient moves through the criminal justice system. So therefore, collecting it at that time is pretty key.

Jason Chute [00:11:29] So obviously for something this critical procedures become essential. Can you talk about what those procedures entail as it's related to bruising and identifying, documenting, collecting that documentation and capturing that history?

Katherine Scafide [00:11:43] Sure. So the first thing you do when you do an assessment or injuries is obviously you need to expose the skin area and you need to then visually assess it with your eyes. At the same time, you use palpation. And when I say palpation I mean you're feeling the skin surface and you know you're looking for swelling. You're looking for any indication of tenderness from the patient. You do this to identify injuries. And for a bruise you typically see some sort of discoloration. And that's caused by crushing trauma to the skin. So crushing or squeezing blunt force trauma and result you get the vessels below the skin surface are broken and they bleed into the surrounding skin, and whole inflammatory reaction happens. And that's why you get sometimes some swelling and pain and all sorts of things. Ultimately, this contributes to that blood breaking down and going through all those wonderful color changes and eventually being taken away. It's important to capture what that bruise looks like at the time of the exam. As clinicians, we run into a lot of challenges with that. Bruises are very difficult to see. Under particular situations, such as on individuals with dark skin, individuals with dark skin pigmentation, that pigmentation actually sits above where the bruise is, making it very difficult to see bruises particular and people with really dark skinned pigmentation. But even medium skin pigmentation can also alter how the bruise appears. It also for bruises that are older, those can be difficult to see too, as they're fading and resolving. So the challenges that we experience as clinicians are that we don't have the tools in place, at least generally speaking, to be able to provide equitable care for victims of violence who have diverse skin tones, particularly in individuals with dark skin tones. And if we can't see a bruise because of their skin pigmentation, then we can't document it. And if we can't document it, then there isn't that evidence to put forward to the criminal justice process. And so then, unfortunately, those particular victims often lack sufficient evidence to get the legal outcomes that they so deserve and at all is relates back to their skin pigmentation contributing to that disparity.

Jason Chute [00:14:05] And I'm assuming that is what drove you to your recent publication at the end of 2023, titled Visibility of Inflicted Bruises by Alternative Light. Can you talk a little bit about what drove you, what sent you in the direction of doing that research?

Katherine Scafide [00:14:19] Sure. Well, we've done a number of studies looking at alternate light. The alternate light is light of a specific wavelength. Normally during an exam, we would use white light, which is the general lighting you see in overhead lighting task lighting, that falls within the category of white light. Alternate lights is just light of a certain wavelength or color, in this case, focusing on the visible spectrum. So I've spent the last, probably eight years doing research, on the use of alternate light and whether or not it can help improve our ability to see bruises or evidence of bruising, I should say, on diverse skin tones. And we are fortunate to, receive funding from the National Institute of Justice and be able to investigate this particular technology or using a randomized control trial. We've published multiple studies, off of that data and what you see here in 2023, the visibility of inflicted bruises and alternate light is our evaluation of whether or not alternate light can improve visibility of the bruises. So we've already been able to demonstrate in a previous publication that alternate light can improve the detection of bruises, of evidence of bruises up to five times greater than white light. That was in an early 20 earlier 2020 publication in the Journal of Forensic Science. Now visibility is different. So visibility is essentially I see the bruise but I don't see it well or I see it really well. It's a measure of

how clearly you can actually see the bruise. So perhaps you do. And somebody with really dark skin, maybe you see something but you don't see it well. So how well can this technology help improve how well we can see it. Because doing so also is really important to capture the injury in photography. So it's very difficult to photograph a bruise that is very faint and difficult to see. So we wanted to see if not only can this technology improve the detection of evidence of bruising, but also can enhance their visibility. So we conducted this study in during our previous randomized controlled trial. And we're just in doing this publication, we were able to analyze that outcome. And we found that violet light specifically 450 nanometers using a yellow filter. Not only did it increase visibility, but it increased visibility to a clinical meaningful level. That would be helpful if it was used for clinical practice. And that's essential because regardless of whether or not it increases visibility, if it doesn't increase visibility in a clinically meaningful way, then it's not going to be helpful. But we were able to find that yes, it does. And that particular wavelength, violet light with using a yellow bandpass filter is consistent with previous research, which we did focusing on detection. It made sense though, and it also was very helpful for us to find another avenue to help these victims who have bruises but that are difficult to see.

Jason Chute [00:17:16] Fascinating work. For our listeners and specifically sexual assault nurse examiners or SANEs that may be listening based on reading your publication. This isn't as easy as running out and buying an alternative light source I'm assuming. Bringing this full circle to what we were talking about earlier. Can you talk about how your research could be responsibly transformed into practice?

Katherine Scafide [00:17:36] Sure. And I'm so glad you bring this up, because it needs to be done responsibly and ethically. And there are many challenges when it comes to using an alternate light source. I never recommend people just run out and buy the equipment, and too many times do people do that. They have some funds left over. They got to spend them, so they buy the equipment and then it just sits there on the shelf. Because there are a lot of concerns about how do I use it, how do I document it, how do I testify to it? And that's probably the most critical one. So you do have to address the who, when, what, where, how and why of using an alternate light source. You need to know who do you use it on. It's not it shouldn't always be used on every particular victim. There are certain situations where it is there is research evidence to support its use versus others. When you use it, you know how old of a bruise are we talking about when it comes to looking at conducting a medical exam using an alternate light source? What equipment should they use? There's so many different devices out there to choose from, and it can be very tempting, for example, to buy the cheapest one you find, which are little tiny flashlights. And yeah, they're great. They're very portable, they're cheaper. But the problem is the intensity of light is not there and sufficient enough to be able to be used for this purpose. So I always advise clinicians, if they're an interested to trial, the equipment out in your clinical practice in order to be able to make an informed decision before purchasing. What do you need to know to use them? Training is essential. Nurses can't just start using this equipment without understanding it and being sufficiently trained not only just with the tactic work, but hands on clinical practice. And that training extends also to those stakeholders who will be impacted by the use of this technology with victims such as law enforcement, prosecutors, even judges. Other things to consider, you know, where do you use it? What parts of the body should you use it on? You should never use it near the eyes, because actually there's some safety considerations when it comes to potential eye damage. If you use it too close to the eye, you got to know how to use it safely, how to document it, both written and photographic documentation in photographing with an alternate light source can be difficult. And then finally, when it comes to testimony, you need to be able to explain to the jury and the judge why you are using it. And what do

those findings mean? So you you have to be comfortable with doing that. Unfortunately, up until recently, specifically my work, there really hasn't been any existing published clinical practice guidelines. That's been crucial in order to be able to recommend people be able to use it in practice, because you need guidelines to tell the clinicians how best to use it that's supported by research evidence.

Jason Chute [00:20:28] And I understand you're working on publishing a set of clinical practice guidelines. Can you talk a little bit about the scope and status of these guidelines?

Katherine Scafide [00:20:35] I was fortunate to receive a grant from the National Institute of Justice to be able to create clinical practice guidelines for using an alternate light source based on contextual assessment of clinical practice. So I investigated how forensic medical exams were being conducted. What were the resources that need to be need for using an alternate light source? What were the experiences of clinicians who did use alternate light source in their practice? And through that process and doing, a systematic review of the literature, we were able to develop evidence based clinical practice guidelines that are available online called At Last, and they really help provide a comprehensive view or guidelines to how best to use an alternate light source in practice that is supported by research evidence. It provides clinical guidance on the setting, the patient situations that warranted its use, it provides step by step procedures, recommendations for documentation, testimony, and training. Safety considerations are spotlighted throughout. And then finally, it which is an essential area to include, we do focus on the limitations of alternate light and really what it can and can't do for you. There's also equipment recommendations for both the alternate light source and camera equipment associated with it. Now, currently these guidelines are located online. We are in the process of having them published. And so they'll be go through the peer review process and be made available publicly. Additionally, we did conduct a feasibility study where we did a formative evaluation of them at a forensic unit that did not use an alternate light source. And we were able to demonstrate their feasibility for application.

Jason Chute [00:22:25] Excellent. And I really appreciate you addressing the limitations of being in forensic science for a number of years, I know this is essential in teaching and forensic science teaching that to students, that knowing the limitations of the technology is absolutely essential. I'm curious, do the standards, do they get into the trauma informed care side of using an alternative light source? I imagine that could look a little different. And that's such a delicate situation now you're turning out lights and coming at somebody with a flashlight or a wand. Can you talk a little bit about that?

Katherine Scafide [00:22:58] Sure. And that's a great question and also a concern that's been raised by nurses or other clinicians who are, worried about introducing this particular practice. And a lot of that comes down to equipment. Choosing the right piece of equipment is key. As I mentioned earlier, if you choose an alternate light source that does not have sufficient, lumens or brightness, then you are forced to heavily darken a room in order to be able to use it and apply it to the situation. And creating a dark room would be nerve wracking for anybody. You also have safety considerations for people tripping and falling and that kind of thing. So what we've identified through our research and use of this particular technology is we have the right equipment. You do not have to darken the room very much, just a little bit. And frankly, from a completely practical sense, darkening a room in a hospital setting is difficult because, you know, there's all sorts of lighting and safety lighting everywhere, so you really don't have to darken the room very much if you have the right equipment. The darkness of the room is one essential aspect to making sure to incorporate trauma informed care. When you're conducting a medical forensic

exam using an alternate light source. Other considerations you need to make are to make sure you explain to the patient what you're doing and the reasons why, and make sure to ask permission to use the alternate light source. I mean, just like you would do for the rest of your exam, you need to engage the patient in the process. You need to have established trust, and make sure they understand the rationale behind what you do, and also consider showing them the images through my work with the, research associated with the development of clinical practice guidelines, I conducted, several focus groups with nurses and discovered that according to them, the patients responded very positively to the technology they felt by seeing these injuries, these images they felt believed, they felt empowered, they felt like the nurses were doing everything they could to support them. They were going the extra mile. So there really does seem to be a lot of benefit, not just in terms of being able to see their injuries, but there's definitely some empowerment and some other, you know, benefits, mentally to the patient or seems when using this particular technology in practice.

Jason Chute [00:25:25] And I imagine this also opens up the inclusivity of who you're examining.

Katherine Scafide [00:25:30] Absolutely. I mean, what I mentioned before was that the we run into so many challenges when it comes to examining diverse victims of violence, particularly when it comes to skin tone. And if we have technology that can help improve how we see injuries, how we're able to then subsequently document them, photograph them, we are creating in a more equitable playing field for all patients to be able to successfully receive the medical forensic exam that they deserve and support them in seeking the legal outcomes that are warranted for them. There is research to support that. When victims of violence have their injuries documented, they feel empowered. They feel I'm believed about what has happened to them. Additionally, when those injuries are documented, the victim is more likely to engage in the criminal justice process because they feel more believed. However, when the injuries are not documented or they are not properly observed, such as using an alternate light source because we can't see them very well or individuals with dark skin pigmentation, they may not be viewed as severe. As somebody with light skin, you could have the same bruise from the same type of trauma on two different individuals, one with light skin where it's very obvious and when you see it, and somebody with dark skin pigmentation where it's not so obvious. And ultimately they think, the law enforcement or prosecutor or jury can think that the injury is not as severe, not as painful, and, you know, wasn't as serious on the individual with dark skin pigmentation compared to the women with light skin pigmentation.

Jason Chute [00:27:14] Unfortunately, we're getting to the end of our conversation here, but I'd like you to elaborate on what's next for you. I did read that you've recently been awarded an NIJ grant to further research on bruising. Could you share a little teaser with the audience on what that entails?

Katherine Scafide [00:27:28] We are fortunate that my interdisciplinary team, which includes engineers and experts in health informatics, we were able to receive, a grant from NIJ to expand our investigation of bruises beyond the assessment of them, focusing instead on the images that I previously obtained in my earlier work. Images contain a ton of data. Just think about the all the individual pixels, and we're investigating whether or not that particular data can then be used to help us understand bruises better. And for the NIJ project, for that purpose, we're actually going to see if we can estimate how old the bruises based on that data. Now, the only way we can do that is to use various methods involving artificial intelligence. And this includes deep learning and computer vision. Essentially,

we're teaching the computer to recognize where a bruise is and to evaluate the different pixels and the boundaries of where it is, and incorporate that with data we collected on the bruise, and then predict future bruise images as to how old they may be with some sort of error rate. And, this is very exciting for clinicians because it's such a common issue with trying to understand how old a bruise is and does it match a given history or given caregiver that may have had them. That's been really a critically missing piece when it comes to various legal issues. And the other part of this grant, we're also developing a bruise image platform. So we're going to take our existing data set of 26,000 pictures of bruises that we have from my previous research. We're going to develop a publicly available platform that will integrate with the computer modeling that we've done to allow future researchers and clinicians to be able to collaborate on that platform. By examining other images, other people can upload images, can then learn about bruise appearance and be able to use that particular technology. So we're excited about the future prospect of being able to have this technology out there as an application.

Jason Chute [00:29:40] Yeah, that's really exciting. Sounds like groundbreaking introducing AI into the process. Be really excited to see the outcomes of that. Before we close are there any final thoughts you'd like to share with the listeners?

Katherine Scafide [00:29:52] I'd like to share two thoughts. You know, one of them is that, you know, when you are working with victims of violence, either in the clinical realm or on the law enforcement side. Just be aware, there are so many factors that go into how their injuries appear. Clinicians and law enforcement, as well as prosecutors, should always keep in mind the potential inequities that can occur among victims of violence, particularly those who have dark skin pigmentation as a result of the injuries looking different in different situations. Additionally, I believe technology has an important role in the future of addressing these inequities, whether it involves new handheld devices that can be used at the bedside when working directly with victims of violence, or further developments related to artificial intelligence. I believe that is the future of addressing some of the disparities we see in those particular outcomes.

Jason Chute [00:30:50] Great, I appreciate that. And with that, I'd like to thank Doctor Katherine's Scafide for sitting down with us and Just Science to discuss improving the detection of bruises on black and brown skin tones as it relates to sexual assault response. Thank you Katherine.

Katherine Scafide [00:31:04] Thanks for having me.

Jason Chute [00:31:05] If you enjoyed today's conversation, be sure to like and follow Just Science on your podcast platform of choice. For more information on today's topic and resources in the field of forensic science, please visit Forensiccoe.org. I'm Jason Chute and this has been another episode of Just Science.

Introduction [00:31:25] Next week, Just Science sits down with a team of researchers and practitioners to discuss the evaluation of an alternative policing program in Indianapolis. Opinions are points of views expressed in this podcast, represent a consensus of the authors, and do not necessarily represent the official position or policies of its funding.