Clinical Chemistry

Non-invasive Detection of Cocaine and Heroin Use Using Single Fingerprints

Article:
Mahado Ismail, et al.
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Guest: Dr. Melanie Bailey is in the Department of Chemistry at University of Surrey in the United Kingdom.

Bob Barrett: This is a podcast from *Clinical Chemistry,* sponsored by the Department of Laboratory Medicine at Boston Children's Hospital. I am Bob Barrett.

Studies have found that drugs are now so prevalent that over 10% of a population were found to have traces of Class A drugs on their fingerprints despite never using any of those drugs. While fingerprints have been suggested as a possible sample to rapidly and noninvasively carry out drug testing, identifying drug users and not those who may have passively encountered a drug can be complex.

In a study published in the June 2018 issue of *Clinical Chemistry* and available online now, researchers from the University of Surrey together with Dutch scientists may have found a solution. They present evidence that their techniques give a zero false positive rate in the fingerprints from drug-free volunteers. Yet, they were able to detect 87.5% of the cocaine users and 100% of heroin users.

Dr. Melanie Bailey is a lecturer in forensic analysis in the Department of Chemistry at the University of Surrey in the United Kingdom and an author of the report on detecting drugs in fingerprints, and Dr. Bailey joins us in this podcast.

Doctor, drug testing is already carried out by clinical and toxicology laboratories using blood, urine, saliva, hair, so why use a fingerprint?

Melanie Bailey: Yeah, quite right. So, a fingerprint gives you a really convenient way taking a sample from a donor or a patient. It's very easy to deposit and it's a very secure way of obtaining a sample because the sample itself gives you the identity of the donor. So, if you think about a forensic situation, it means that you have a very secure way to retain this custody of the particular sample. Or, if you think about by a medical situation where you might want to be testing in a hospital setting, it just increases the traceability of that sample.

Bob Barrett: It must be complicated getting the results using fingerprints and I was surprised to learn that a large proportion of paper currency is contaminated with drug residue. That must make it difficult with regard to false positives.

Melanie Bailey: Yeah, that is exactly the assumption that we made particularly when we found that the number of people that we tested who were not cocaine users were coming back with cocaine in their fingerprints. But actually what we found is that the levels of cocaine that we see in their fingerprints is significantly less than the levels that we're seeing in drug users who are testing positive to cocaine use.

And so, actually what we're able to do is construct a threshold for significant, the cut-off level, that allows us to screen out all of that environmental contamination, what you say, from touching bank notes and things like that, to actually determine drug use over just the environmental exposure.

Bob Barrett: The amount of drug metabolites in the sample must be very low. What are the typical concentrations and what are your limits of detection?

Melanie Bailey: Yes, they are very low so our limits of detection of that technique is the picogram level. So we measure picograms (pg) per fingerprins and we don't necessarily know the volume of the fingerprint that's been deposited. So, our unit is somewhat different to the sort micrograms, nanograms, per mil, that are used in drug testing.

So, at both those levels, a typical fingerprint from a drug user has hundreds of picograms contained within it compared with our tens of picograms limit of detection. So, it's significantly greater than what our techniques can pick up.

Bob Barrett: Well, what about subjects who wash their hands or what about people who shake hands? Does this complicate the analysis?

Melanie Bailey: It does and it doesn't. We initially tried carrying out our work on people who hadn't washed their hands. So, we took samples from both drug users and non-drug users without hand washing. And what we found, that it was quite difficult to get a right best test in that way because if the person then goes on to wash their hands, the cutoff that we have to use to exclude environmental contamination was so high. But then, we were missing people after they had washed their hands. But it's actually quite easy to get around that.

What we actually do is we wash everybody's hands and then we can set our cutoff level lower and that enables us to then catch a much larger number of true positives. You would say, "Well, how about shaking hands with a drug user?" So, we have actually tested our technique and what we found is that, if you shake hands with a drug user, you do actually pass traces of cocaine from the drug user to the non-drug user. But those traces are low enough that they're actually below our cutoff level. So, we believe that the test is very vast enough to account for shaking hands.

Bob Barrett: Okay. So, what does your study say about the applicability of testing for illicit drugs in a fingerprint?

Melanie Bailey: Well, I think it leads the situation on from previous publications that found it's possible to detect cocaine in a fingerprint, that you can see the metabolites with cocaine in a fingerprint, but none have really looked for the significance in this problem, which is pretty much unique for cocaine of environmental exposure. And I think what we've shown is that although there are small traces of cocaine which are prevalent in the environment, the level of cocaine that you actually see in a fingerprint from a drug user is actually significant and it's above those levels. So, we come away with the conclusion that actually testing for drugs from the fingerprint is very applicable.

Bob Barrett: Do you think that these analyses will hold up to possible legal challenges?

Melanie Bailey: Well, that's yet to be seen. We obviously haven't tested the environmental levels of cocaine with everybody in the world. We couldn't categorically rule out that cocaine found in a drug user's fingerprint isn't from any other source, but there is very good evidence to show that there's a good correlation between cocaine use and the level of cocaine that's seen in a fingerprint. And so, this is to be used, for example, for workplace testing or to support rehabilitation of offenders. We can give a very good indication from a fingerprint that somebody has taken cocaine.

Bob Barrett: Are there any other applications for fingerprint testing or do you see it restricted only to drugs of abuse?

Melanie Bailey: Not at all. Our colleagues are working with clinicians in several areas to explore the use of fingerprints for increasing compliance with certain types of medication and we're putting together a manuscript on a very exciting application in that particular area at the moment.

Bob Barrett: Well, finally Dr. Bailey, let's look ahead. Where do you see this work five or even ten years from now? What are the challenges you think you'll be facing in the future?

Melanie Bailey: I think my group is particularly interested in spreading this work outwards into the biomedical community. So, seeing what we can see with the fingerprint either for medical compliance, to check if the patient is actually taking a treatment, but also to see what biomarkers are available in a fingerprint. Could we use a fingerprint for disease diagnosis? Those sorts of possibilities of providing a sample very easily and rapidly that we think is an advantage that fingerprints can provide.

In terms of challenges, a fingerprint is a very small sample. At the moment, we can't control the mass of the fingerprint that we're depositing. And so, actually getting a quantitative value at the level of a particular substance in a fingerprint represents significant challenges. It's something that we're working on and it's something that we're very keen to see when in collaboration with others, and I think it would make the real difference between using a fingerprint in a qualitative sense where you can -- and you really provide a yes or no answer in using a fingerprint as a quantitative analysis.

Bob Barrett: Dr. Melanie Bailey is in the Department of Chemistry at University of Surrey in the United Kingdom. She's been our guest in this podcast from *Clinical Chemistry* on detecting drugs in fingerprints. I'm Bob Barrett. Thanks for listening.