Welcome to the forensic toxicology podcast. My name is Dr. Santa LAM Arctic. I am an assistant professor in the Department of Forensic Science at Trent University. Today's podcast will be on the topic of confirmatory testing in forensic toxicology. You will hear about two cases that focus on use of non confirmatory as well as confirmatory methods for detection of drugs and metabolites. You will also see here how these tests and methods contribute to toxicologists interpretation and guide their interpretation of data and ultimately reporting. Let's look at the case one, R versus gave her 2016 YK SC County. Ms.

Jess well, next proceeded to conduct chemical testing as required by das document entitled standard operating procedure or SOP. Sop document indicates the need to conduct two tests, one non confirmatory and the other confirmatory. The combination of those two tests at the minimum allows the analyst to draw conclusion. The non confirmatory means that the test is not conclusive as to the composition or a structure of a substance. Whereas a confirmatory test, it provides information on the compound structure and molecular formula and his capable of identifying a drug in the midst of very similar looking drugs. So what did miss jazz While do? She first conducted non confirmatory tests and she use gas chromatography. Gas chromatography as spelled out by the SOP document for confirmatory testing. What Ms. Jess Wahl did is she use gas chromatography coupled with mass spectrometry. And that linking are hyperlinked of GC with MS allows one to have a structural identification of the compound as well. Let's look at more detail into non confirmatory tests performed by Ms.

Jess Wahl, GCS listed and the SOP indicates that the result must be consistent with published data for that particular substance. It also states that if neither a dashed reference standard nor documentation of relative attention time run on das equipment is available. The test results should be consistent with published data for that sub $0.02. You can see here that when the analysts takes the sample and runs this on GC, there will be peaks, a specific retention times. Each peak at a specific retention time is linked to a compound being present in that sample. Of course, the DAS reference standards have been run using GC as well. And they have their own unique retention times. By matching the retention times between the sample with the reference, one can deduce that indeed is the compound. The SOP also notes that the CPS or product identification guides published auto manufacturer's website can be used as a non confirmatory test for a pharmaceutical product with manufacturers marking. Of course, this is if available. Now, the non confirmatory GC test was positive for the presence of methylphenidate by the noted relative retention time of the observed peak in that chromatogram, the relative retention time was a match with the relative retention time of the verified reference standard and was within the accepted criteria established for the relative retention time of the reference there a 100. So it sounds like there is a match. What about the confirmatory tests? So the acceptable confirmatory tests are typically based on mass spectrometry, although sometimes infrared spectroscopy can also be used. In this case, it was the mass spectrometry coupled to GC that was used as a confirmatory method. Again, the test sample spectrum, because the Mass Spectrometry will give you a spectrum with peaks. Dye will provide information about the molecular weight, molecular formula of the drug as well as its fragments. The sample test, it has its spectrum and it needs to be compared to a published spectrum for that same chemical. And there's additional note that reads that if a desk reference standard spectrum around on das equipment, that would be ideal. But if it's not available, then the sample spectrum may be compared to a published spectrum. We know literature, there are a number of different protocols listed as more guidance with that matching. Even confirmatory test was positive for metal affinity as the mass spectrum for the observed peak in the chromatogram match the mass spectrum, the verified reference standard, in addition, denoted RRT peak from the chromatography of the observed peak match the RRT of the verified reference, and it was within the acceptable limit. Now we have that the results of non confirmatory and confirmatory tests are in agreement. Not even though that is the

case. Because mental affinity state is a weak, fragmented, meaning it likes to show up in the mass spectrum as a single peak which is at methylphenidate. And it doesn't like to produce smaller fragments in the mass spectrum. This is the case. That means that you really don't have fragments. To consider and having fragments would allow you to further confirmed the structure because of fragments are basically segments of your parent drug. So by looking at the fragment, It's like a puzzle piece. You can put them together to come up with a final structure. Methylphenidate is a weak fragment or the DAS lab required an additional third test in order to confirm the mass spectrometry results. Even though those were confirmatory, the specific common reads, ambiguous MS spectrum, RAR or third test required, refers to, as I mentioned, to infrared spectroscopy testing. This was it done by Ms. Jazz swell specifically in Mrs.

jazz volts case, but there was no lab requirement that Mrs. Jones, while conducts infrared testing rather than protocol required. A third test.

What happened was that Ms.

Jess will indeed conducted two additional tests. She conducted a non confirmatory GC tests on the Halifax machine using the Montreal Protocol and a visual comparison of the tablet to the CPS. This third test that she conducted was positive for depresses of metal standard date, as noted by the retention time of the observed peak in the chromatogram again, which matched again to the reference relative retention time in the verified reference standard. And this was within the acceptable criteria. Again, the SOP requires that the results from both non confirmatory and confirmatory tests be compared to that reference standards in preference to other published data or spectrum. In this case, you find that the toxicologists or forensic chemist has to follow protocols in place. At minimum, non confirmatory and confirmatory analysis needs to be conducted. In this case, they were and they were match. Because if you look at the details of confirmatory testing and we looked at the mass spec of this metal affinity drug in the presence of having a mass spec, even though it's a match the reference mass spec if the fragmentation pattern is very low. But then additional third test is required. This case, Ms.

Jazz will conduct two other ones to satisfy that criteria. Let's look at the case to our versus Jordan, 1984635 bc ca. In 1982, mid-September, the appellant arrived by air from Tokyo at Vancouver International Airport earlier that day. And RCMP sergeant has spoken to superintended flag of customs at the airport and indicate that he was interested in a person named Robert Christopher Jordan. He told him that Georgia was connected with travels over the orient and with purchasing heroin. The envelopes found in the appellant luggage were turned over to an RCMP officer who in turn turn them over to a designated Analyst, Mark Clark, Mr. Clarke then analyze the substance found in the envelopes and font them to contain Heron, and then prepare certificates of analysis dealing with each envelope which certificates were entered as exhibits to this trial. And Mr. Clarke was then called for the purpose of cross-examination in more detail. Two days later, September 20th, Mr.

Clark performed a quantitative analysis. The substance found in the envelope taken from Mr. Jordan's luggage, hereafter named as unknown, constitutes as a non confirmatory testing. The test performed was chromatography, either gas or liquid chromatography. This was the only tests performed on that date, meaning two days following the obfuscation. And this test is not specific with regards to heroin, as we know, chromatography only gives you a peaks at specific retention times, but it doesn't confirm the structure, doesn't give structural information. The test does not establish whether or not the unknown is heroin. In running the test, Mr. Clarke use what he believed to be a known standard of heroin here called unknown. And then compare the two results between the known to the results of the unknown. Basically, Mr.

Clarke had two chromatograms and he looked at the two peaks. And he looked at retention times between those two peaks to see if there's a match between reference and unknown. Now this is still very presumptive testing. At no time did Mr.

Clarke ever performed a color test, for example, he didn't perform a micro crystal reaction test. You didn't perform IR infrared spectroscopy test or even ultraviolet visible spectroscopy desk on October 4th, which is several weeks following the confiscation of the material, Mr.

Clark performed a test to identify the unknown. So this seems like there's a need for confirmatory method. He performed gas chromatography, mass spectrometry tests. This is a test which combines two instruments. First separates the organic compounds, meaning to GC. And the second mass spec allows for identification of the separated compounds and figuring out their structure. Mr.

Clarke based his opinion that the unknown contained heroin on the results of this confirmatory test. In the absence of this test, Mr. Clarke could not have said that there was heroin containing the unknown. But now in this test, the separated compounds are bombarded with electrons producing a graph spectrum of the molecule. This was done with the unknown Mr. Clarke than Ron. In tests with the known. And again, you can see that the technician is trying to generate spectra for unknown and spectra photo known so that it can compare the two against each other. He didn't compare the graph of this unknown to the graph of the known. He also compared the graph of the unknown to a compendium of supplied data to his laboratory by the National Institute of Health in the US. Mr. Clark testified that he would not rely on one test only, but he required these multiple tests to reach his opinion. So combining the presumptive tests in September with the confirmatory tests from October. Mr.

Clarke, it relies on the certification by one of the other five or six analysts at the Vancouver lab that denote was in fact heroin. That substance was sent to Vancouver from the RCMP Central Drug district or the crime detection live in Ottawa. It was labeled as heroin, but Mr. Clark did not rely on that labeling. The practice which Mr. Clark believed was followed in this case was that an analyst perform various tests on the substance and then certify it to be heroin. Another analyst, not Mr.

Clark, performed a certification of denote. This particular case also has a dialogue included. The dialogue is based on the evidence relating to the testing and certification of the known sample. And he's as follows. In order to have this method work, you have to have a known substance. Isn't that correct? That's correct.

You must compare your analysis to suffering in order to reach any kind of conclusion at all. All right. If you have to know what the known substance you are comparing it to is. That's correct. In this case, you indicated that you use a known sample of heroin.

Is that correct? That's correct. All right. Where did you get that sample from? Our standards are sent to the crime detection laboratory from our central drug district or in the crime detection laboratory in Ottawa. They appear There's labeling on them that indicates to you that they are heroine. Is that correct? That's correct. Alright.

You rely on that labeling to perform the test you use? No, we do not. Once a standard is received by our section and designated member analyzes the white powder as if it were an unknown, checks for its purity via their melting points of the compound. Comparisons best spectra to mass spectra, which had been published in

scientific literature. It is NDT certified by the analysts that perform those tests and is then available for use by the other analysts in our section, right. With regards to the known compound used in this case, you did not perform that certification. It was done by another member of the Vancouver drugs section. Isn't that correct? That's correct, Yes. This case also has a second dialogue which is focused on the evidence relating to the United States graph, which goes as follows, that's recorded on the graph. Is that correct? Yes, it is. That wrath is in a sense a fingerprint of that molecule. Would that be a fair analogy? Yes, it is. Alright.

You then use the you have that graph? Yes. You then run a second test with the known substance? Yes.

Alright. In this case, the heroin that you have described earlier that you knew? That's correct. All right.

And then you compare the two graphs? Yes. I compare the unknown spectrum to a known standard which has been generated in our laboratory. And I also compare the unknown to a spectrum which has been published in the scientific literature. What scientific literature did you use in this case? In which I specifically compared to it, we have a compendium in the laboratory of a number of spectrum. It was published by the National Institute of Health in the United States and the mass spectrum collection. And their number is 379, if you will, the American version of a standard that sometimes come from Ottawa. Yes, we have another volume now which is published by agriculture Canada that does the same thing. You, the important comparison DO is the comparison that uses the same machine and the same scientific parameters. Is that correct? The known with the unknown. Well, I wouldn't say that it's more important of the two. Would it be fair to say that the combination of the two gives you the certainty indeed? Yes, that's correct. I wouldn't rely on either simply a public spectra from the literature or on simply as factor which I had run in my laboratory. I prefer to rely on two sources. It's your opinion that that gives you the confidence you need? Yes, that's correct. You heard two dialogues in this case. In this case, on appeal, the analyst testify that the substance received from Ottowa was labelled heroin and was tested by an analyst in his office, not by himself. Such a course it's perfectly proper to call the analysts who made the test of the node sample is necessary. If such an hour's was called, it would, according to the argument of the appellant, be necessary for him to prove that the substance he used for comparison purposes was heroin. And underline.

And underline. Such an argument while logical, cannot be accepted because it would make scientific proof so ponderous, inexpensive, that in reality, the evidence of experts could never be used. The white powder in the envelope was as admitted by propellant in our aquatic obtained by him in Bangkok. Such evidence is indeed powerful evidence and a trial judge might well be justified in concluding beyond a reasonable doubt that the admission of the appellant was positive proof that the substance was Herod. The tests employed by the analysts were correct in every aspect. The use of the United States graph was properly done. The analyst as an expert, was entitled to use if your data as he deemed necessary. There was no evidence to indicate that the United States graph was not in reliable source. You just heard about two cases where not confirmatory or presumptive and confirmatory tests were conducted, compared, analyzed, interpreted, and reported. Ultimately, this podcast was on the topic off confirmatory testing in forensic toxicology.