Just Wastewater Drug Surveillance in Kentucky (1).wav

Introduction [00:00:01] RTI International's Justice practice area presents Just Science. Welcome to Just Science, a podcast for justice professionals and anyone interested in learning more about public health, innovative technology, current research, and actionable strategies to improve the criminal justice system. In episode three of our Community Based solutions for Substance Use Challenges season, Just Science sits down with Doctor Chris Delcher, associate professor in the Department of Pharmacy Practice and Science and director of the Institute for Pharmaceutical Outcomes and Policy at the University of Kentucky, to discuss how his team tracks community drug use through wastewater analysis. Much like analyzing a urine sample to determine what drugs an individual is using. Analyzing wastewater from a community offers insight into drug trends across an entire region of people. The NIJ funded We Test program allows for the collection and analysis of wastewater from rest areas and truck stops in Kentucky to track current drug trends in a timely manner. Listen alongs Doctor Delcher discusses his inspiration for using wastewater to monitor drug use, the sometimes messy process of collecting wastewater samples, and how scientists approach ethical considerations that come with collecting data from wastewater systems. This Just Science season is supported in part by RTI award number 15PNIJ-21-GK-02192-MUMU awarded by the National Institute of Justice and by RTI award number 15PBJA-23-GK-02250-COAP awarded by the Bureau of Justice Assistance. Both are agencies within the Office of Justice Programs, U.S. Department of Justice. Here's your host, Doctor Lawrence Mullen.

Lawrence Mullen [00:01:48] Hello and welcome to Just Science. I'm your host, Doctor Lawrence Mullen, with the Forensic Technology Center of Excellence, a program of the National Institute of Justice, or NIJ. NIJs forensic science mission, is to strengthen the quality and practice of forensic science through research and development, testing and evaluation, technology and information exchange. One funding source provided by NIJ is the Research and Evaluation on Drugs and Crime Solicitation. We are here today to talk with Doctor Chris Delcher, who was awarded a NIJ grant in Fiscal year 2020 for wastewater epidemiology, to examine stimulant trends. I.e. We Test here to help us with the discussion is Doctor Chris Delcher. Welcome, doctor Delcher.

Chris Delcher [00:02:31] Hi Lawrence. Great to be here.

Lawrence Mullen [00:02:32] Just to get us started. And just kind of like ease into this. Can you tell the listeners about your background and what led to your current involvement in wastewater epidemiology?

Chris Delcher [00:02:40] So I am an epidemiologist by training. I got my master's degree from the University of North Carolina at Chapel Hill in Environmental Science and Engineering. But then I went on to get my PhD in epidemiology from the University of Florida. So as an epidemiologist focused in particular on drug use, I'm always on the lookout for some type of unique data set, something that will give us a heads up faster than what we normally work with in terms of understanding drugs, coming into communities and going for the wastewater seemed like a great way to do that.

Lawrence Mullen [00:03:19] Interesting. As we dive a little bit deeper into the main topic here that we're talking about, can you explain to the listeners what wastewater epidemiology is?

Chris Delcher [00:03:27] I will do my best. So wastewater epidemiology really is the science of collecting wastewater. So imagine essentially when a community collectively flushes its toilet, it all goes to a wastewater treatment facility hopefully and gets treated. And then the community may do something with what comes out of the wastewater treatment facility. But what wastewater epidemiology is way of taking the wastewater before it gets to the treatment facility and analyzing it chemically to understand what substances may be in that water. And we're interested in pharmaceutical substances, but other groups may be interested in viruses, bacteria, all sorts of biological materials would also count, but our work focuses in on the drugs that you might find in wastewater. And the reason that it's a valuable source of data is it reflects what people are excreting from their bodies, which indicates the drugs that they're using.

Lawrence Mullen [00:04:31] Thank you for that explanation. Are you able to maybe more so, elaborate on the importance of wastewater epidemiology in the surveillance of drug overdose and misuse?

Chris Delcher [00:04:41] When I described myself as always being on the lookout for sources of data, that will give us an earlier glimpse into community drug use. So why does that matter? Well, typically an epidemiologist like myself, we have to wait until we see a death certificate to know what a person has been using or has overdosed on. By the time I see a death certificate, those drug use patterns may be two years old in the country right now. Typically, the CDC, which is the agency that centers for Disease Control and Prevention, they're the agency that would be responsible for examining death certificates and putting out statistics on the types of drugs that are affecting the country, that system. It takes about a year and a half or so to get information out of that system. They're working on modernizing process to speed that up, and they're doing some other things like making predictions more available. But everyone in the field kind of accepts that by the time we're looking at data, it's too late. So wastewater is interesting because you can essentially get real time information. If you can tap into a pipe, you sort of know what's going on at any given time in a community. Now the chemistry gets more difficult, and there's obviously delays and analysis that needs to be done. But if you're looking for new stuff coming into a community, we did an interesting piece of work where we were looking for xylene, which is a veterinarian sedative that is in the fentanyl drug supply right now in the United States. So we equip our chemistry to be able to detect that in wastewater with the idea that if you're able to detect it faster, obviously, you can get interventions out into the community faster. Law enforcement could respond faster to a new type of drug that's coming into the community. So that's really the spirit of wastewater epidemiology.

Lawrence Mullen [00:06:39] You know, you're talking about the benefits and it seems like there are plenty. Would you be able to speak to some of the stigma or challenges with wastewater epidemic?

Chris Delcher [00:06:47] I can spend all day talking about the challenges. I've actually been out in the manholes. We don't actually have to send people into the manholes. We have these robots that we set up and you can imagine, just think about a manhole on your street, open up the cover. You set up a little robot that sits on the street, and there's a hose that goes down into the hole. And then that robot, you can program it to pull a sample on a regular basis, and it can be every 15 minutes. It can be every 30 minutes every day. Whatever it is that you've decided is a good sampling strategy for your project. So we set these up. Our project, which was sampling rest areas and truck stops along highways in Kentucky because we wanted to kind of understand those populations and sort of the flow of drugs based on what we're finding in the wastewater. We set these up at 6 or 7 rest

areas, truck stops in Kentucky. We let the sampling go. We had the cooperation of the staff at the rest areas and the truck stops. So they would actually every day after the robot finished its sampling, they would go collect the sample, which is basically like getting a bucket and pouring it into bottles for us. And then we had little fridges set up at their rest areas and truck stops. They put those bottles in the fridge once a month. I would go round them up, get them into the fridge back at the University of Kentucky where I am now, and then get them off to another laboratory, Murray State University, which is another university in Kentucky for the chemistry, so that the logistics of that were kind of a challenge, as you can imagine. Surprisingly, the cooperation we needed for the project was very, very smooth. So we needed the cooperation of rest areas and truck stops. We needed the cooperation of law enforcement at those truck stops. What you have in mind for a truck stop is like a big convenience store type thing, but it's it's those areas along the highway where trucks will pull in and the way themselves before they continue along. So if you've ever driven by one of those, you also notice that they're usually it's like a state trooper that is set up at those facilities. That's in case they're, you know, there's any contraband or anything found in trucks as they're coming in and getting weighed. So we had to get their cooperation. We had to get the cooperation of the Department of Transportation. We had to get the cooperation of the water companies, the wastewater treatment facilities, although we were sampling our samples, never made it all the way to the wastewater treatment. We got them right near the restrooms in these facilities. So that coordination was really extraordinary in Kentucky, and the project would not have been possible without.

Lawrence Mullen [00:09:27] It seemed like there were a lot of like logistical challenges, but it looks like you all were able to get past them. Going back to the heart of this, how did you identify the need for a study like this?

Chris Delcher [00:09:38] Great question. Again, you know, I'm always thinking about what sources of data are out there that no one is thinking about that could be useful to understand drug use patterns in communities. At the time that we proposed our study, as you mentioned in the introduction, our project was awarded in 2020. Okay. Well, everybody knows that happened in 2020 COVID 19 emergency. So that meant though that we were preparing our proposal before COVID. So we didn't think at the time. And when I say we I mean my colleague who's a chemist now, he's been doing this much longer than I have. We didn't really think NIJ would go for this because we thought, there's no way in the world that anyone really kind of has their head around what wastewater epidemiology is. But we based on his experience and my experience, we knew the science was solid and then we actually benefited from COVID in many ways because people started to test wastewater for evidence of COVID. So we think that the awareness of the importance of wastewater really rose in the country. And what we want to do for drugs is kind of model ourselves after what is happening with COVID or what happened, which is the science shows that you can see an increase in the viral load of COVID in the wastewater about two weeks before you start to see increased hospitalizations from COVID, you get about a two week window of opportunity to prepare as a community, to prepare as a hospital for the influx that's coming. So that's kind of the spirit of what we want to do with drugs. Same thing if we detect some new drug that we know is going to hit hard in a community, we want to get an early look at that and be able to let the law enforcement, public health agencies in an area, know get ready for this. It's about to hit. That's always the challenge. I mean, we're always behind the cartels, right? So we're always on the lookout for some advantage. But it also requires the science. That's part of it. This isn't just about setting up sampling site. It's still a new science that needs to be understood. And so we're hoping that our work will will shed some light on that science. And I forgot to mention the weather.

So the weather was also an issue in Kentucky. So you can imagine we were out there sampling and snow and storms and tornadoes. We had a tornado outbreak in the western part of the state, and luckily our robot somehow survived when many of the homes out it near those tornadoes didn't. So we kind of got lucky.

Lawrence Mullen [00:12:13] Now, this question may be outside of the epidemiological scope, but does the influence like you bring up, like, you know, the weather and the elements and like the changes like rain and snow, does that impact the sample results in any way?

Chris Delcher [00:12:28] Absolutely. And that's part of the science. So one thing that we have to do to understand the level of drug use in a community is it's not enough to just test the wastewater and say, yep, there's a positive signal for methamphetamine. We have to get the concentration of methamphetamine, and then we have to know how many people are passing through, in our case, the rest area or the truck stop. And then we have to know what's called the excretion rate. So if someone is taking methamphetamine, we have to know something about, well, if they when they go to the bathroom, how much of that comes out and then what kind of chemical format. And then the other big piece of that, getting to your question is to understand how much water is flowing through the system. So how dilute is that drug. So using all that information we then are able to kind of what we call it back calculation of the rate of drug use based on all those factors. Now the weather. Great question. So for example if you've got an area where you're sampling, you know, the water that's coming through the system because we call the water company and we ask how much water is flowing on a daily basis through this rest area. And they can tell you that. And so that's another piece of that coordination. But what if the pipes are leaky underground? And what if when it rains, that water that's soaking into the ground is actually soaking into the pipes. So there's actually more water that's coming through those pipes than what you're getting from the water company. So all of that can play into those measurements. Now, can we deal with all of that variability in the weather and all of those details? Not really. At this point, we didn't make an effort to try and understand, you know, when the last time the pipes were replaced in that I mean, you can imagine that's a lot of work. So there are methods that you can do. You can deal with that statistically and make adjustments for possible error. We can get weather data pretty easily as you can imagine. So we can understand on any given day, you know, going back and looking at the data, what the temperatures were like, what the rainfall was like, all that sort of thing.

Lawrence Mullen [00:14:42] So as we think more about wastewater epidemiologist approach, can you elaborate a little bit more on how this study can contribute to the community's approach to the overdose epidemic?

Chris Delcher [00:14:55] Yeah. How would a community use this information, and would they have any issues with it? Well, that's actually an active area of science, is to understand if we give a community information from their wastewater system, what is it that they would even do with it? How would they react to it? What is it that they would want to see? What programs, what interventions, what would they do differently? And the COVID work has really gone a long way to understanding that and doing community surveys about COVID dashboard. There's several counties and states around the country that have dashboards that are showing on a near daily basis, the level of COVID in the wastewater. The drug world isn't that developed yet. So that will become an interesting question. The stigma issue is interesting because the concern around wastewater testing is that it's essentially like an open system. You know, I can walk out to the building at RTI where you are. I could test the wastewater coming out of your building, and we can look at

the at the profile of drug use in your building. So you can imagine as you get into a, an area where there's fewer and fewer and fewer people, you can start to get information on individuals potentially. Right. I could go to my house and I could tap into a pipe and I could get it tested for drugs. So it starts to depending on where you're doing that sampling. But that's where the ethics of the researchers and just sort of the idea of privacy and confidentiality come into play. Can I tell that it's Lawrence? If I go to your building and I test the wastewater, can I tell that Lawrence is contributing to our samples? No. I cannot, right. So that's good news for you, Lawrence. That's some of the concern is people think there are fragments of DNA that are there. You can imagine, but not in any sort of condition or completeness to be able to identify any particular person. So that's one of the benefits of community. Wastewater surveillance is that it's considered, you know, non identifiable source of information on drug use, if that makes sense. It tells you about the drug use but it's not telling you who exactly. But still that's something that as researchers in this field we always have to be cognizant of that. If you go into a community, especially if it's a community that has had issues with drug use in the past, you want to make sure that you're coming in with something that is new and helpful to them. You don't you don't really need to tell them something they already know. That that was one of the reasons that we chose to do rest areas and truck stops is that we weren't really prepared scientifically to kind of work at the level of a community, because those are transient locations in the state. There's really no issues with trying to communicate results to the community. But that's where we need to go, though.

Lawrence Mullen [00:17:39] And then the approach to the overdose epidemic, all of those things would just help to kind of reshape that approach and basically shed a little bit more light on potential up and coming drugs.

Chris Delcher [00:17:49] Either that or, you know, cyclical patterns, because you could have a community that has had a problem with fentanyl in the past. And let's say that the community takes action and believes that fentanyl use has been reduced in their community, and the wastewater may indicate there's a resurgence in fentanyl. And so that would then lead the community leaders to understand what's going on. I thought we had taken care of this, or it doesn't necessarily have to be like a new drug that's emerging, although that's one of the benefits of wastewater. It could just tell you about ongoing use patterns in a community. And yeah, the idea is that when we started this work, interestingly enough, we started it at a football game at the University of Florida, and we did that because imagine a football stadium. It's kind of like a little closed petri dish for that period of time that the football game is going on. You know exactly how many people are in there from the ticket sales, right? You know exactly how much water is going through the stadium. You can pick areas of the stadium that are a little bit different that kind of replicate different communities. Right. You got the student section, you got the visitor section, you got the home section. So you had this really neat little kind of research set up. We did some work at the stadium, and the idea to sell the university on that project was that in the future, imagine you're at a big game like that, and all of a sudden the wastewater detects something unusual. I don't know how many people are actively using drugs during a game. Probably not that many, but other than alcohol, let's don't forget about that. But imagine a scenario where in real time, you could send out a social media, alert to everyone in that stadium to say, hey, we detected something in the drug supply, and they do this like an electronic dance festivals and things where it's kind of known that people are using drugs. You're trying to take like a harm reduction type approach to it, to say, we know you're using there's way too many people that we're not going to really deal with this from a law enforcement perspective. But we just want you to know this is circulating in the drug supply. You need to take precaution, that sort of thing. So wastewater is a way to do that

and to alert the community kind of real time. If we have that set up, we're not there yet. But that's the goal.

Lawrence Mullen [00:20:10] Do you know if any other countries are doing this type of like wastewater epidemiology research?

Chris Delcher [00:20:16] Yeah, there's several countries doing it better than we are. To be honest. That was part of the motivation of this project was you got to start somewhere. Let's start thinking about the logistics and what it takes to do a project like this. The European countries that are testing their wastewater treatment facilities in major cities on a think it's almost a daily basis. They're testing for, I don't know, 50 to 60 drugs on a daily basis in most major European cities. And all of that gets aggregated up to the European Union level. And they are constantly putting out reports on that. They did something interesting recently from a law enforcement perspective, since we're talking NIJ here, there was a big takedown of a group in all of Europe, and it was suspected the operation took out ex tonnage of methamphetamine out of the market in Europe. Well, because in Finland in particular, Finland's got an amazing network of these wastewater treatment facilities that are testing for drugs. Finland actually could look at methamphetamine levels in their country before and after that big takedown, and they could visibly see from the trends in the wastewater. They could see a decline in methamphetamine use in the country at the precise timing of the operation. So they were able to kind of tie that to an effective takedown by Interpol, I think. Who was in charge of that. That's also a really interesting use of wastewater epidemiology is to look at policies that you think might affect drug use and whether or not those policies were effective law enforcement operations, other types of public health interventions.

Lawrence Mullen [00:21:59] So shifting gears a little bit here. Can you tell the listeners about the study design and what outcome measures you were looking for or are looking for rather?

Chris Delcher [00:22:08] So the study was set up so that we had pretty solid geographic distribution across the state, within the limits of what we could sort of handle in terms of staffing. So we had rest areas along I-64, I-75 in the western part of the state, in the northern part of the state, which is up near Cincinnati, Ohio. That might be a good reference for people and then down towards the border with Tennessee. So we tried to get a nice geographic distribution. We sampled both sides of the highway traffic. And, you know, you always have like a north and a southbound rest area, right, or an east west, south bound. So we tested both sides because we were interested in the directionality and whether or not the traffic coming in from Illinois, for example, did that population reflect a different type of drug use than the population coming up from Tennessee in the South? And we did find some differences in terms of cannabis, which is kind of interesting because basically, north of Kentucky, medical cannabis is legal. South of Kentucky, medical cannabis is illegal. And we could see some differences in the concentration in the the amount of cannabis coming in from the north versus the south. So we had set our sampling sites up so that we could hopefully speak to some of those differences. We did a very intensive sampling, so we did sampling for seven days in sequence for every month, for a year at all seven of those sites. So imagine in let's say it's January, we go January 1 to 7. We sample every 15 minutes. Think about this every 15 minutes on January 1st for 24 hours. Collect those samples. And that's just a mix it but reset it for January 2nd every 15 minutes. Go collect those samples. So we do that for seven straight days. And then we do it again in February. And then we do. And then we do it again in March. And then we do it again and in April across all of those sites. The reason we did that was because of you

can imagine, we were trying to deal with difference in, in, in the seasons differences even in the week. So what we also did was we tried to design our study. So we were sampling around periods of time where we knew drug use might be higher holidays. You can imagine July 4th people are driving and getting to their vacation spot. So we expected to see some differences in in drug use. So we made sure to sample those periods of time as well.

Lawrence Mullen [00:24:49] Oh that's really interesting. So like did that show you anything different? I would just show you some like spikes in usage, like maybe during the summer because people are more free to travel or is it seasonal change or seasonal depression, which is kind of like something that happens around that Midwest area.

Chris Delcher [00:25:05] We haven't quite finished looking at all of that yet, but guess what happened? We already talked about it right at the beginning of our sampling of our project was COVID. And guess what? People were not doing during COVID. They weren't out there using the roads very much. We got kind of messed up in terms of COVID, but we recovered. And so we're kind of looking at that data now. But you're exactly right. There's definitely seasonal patterns. There's definitely even different types of drugs that people might use during Christmas versus the July 4th weekend or whatever. And so I also want to say to like, it may sound a little bit shocking when we're talking about, you know, people who are using cocaine, methamphetamine, fentanyl, and they're driving their cars on the highway. So good point for me to like, say that we don't know if the drivers of the cars are actually using the drugs. It could be passengers, for example. So that's a limitation of our study, is we're just getting that traffic coming through there. And hopefully it's not the drivers. But you know, it certainly could be even in the truck driving population. Historically, truck driving population has had issues with the use of amphetamines because it helps them stay awake for long hauls. But even with that population, whenever we have results from those sites, we still have to say, you know, we can narrow it down to the drivers per se, if that makes sense.

Lawrence Mullen [00:26:32] That makes perfect sense. So what about collaboration? What kind of collaborations are needed for success?

Chris Delcher [00:26:37] I mentioned a few already, so we had the the transportation department was critical because you can imagine as a researcher you can't just show up and. And dive into the manhole at the rest area, right? I mean, one, you have to have somebody to open the things. Not like the one you see on the street. There's usually like a lock around it. And, you know, somebody has to come out and open it up for you. So all of that coordination is required. Like I said, we had staff at those facilities who were helping us, so we had to get their supervisors to approve to let them take some time out of their day, which they love doing, by the way, because, you know, it was just such a different thing for them than their daily routine that they really enjoyed. As gross as it may sound, they really enjoyed getting those samples for them into the bottles for us and getting them on ice and then hearing about the science. They were really interested in what we were finding, so we made sure to to communicate that back to them. The water companies, the police. Like I said, you don't want to get arrested for being in a manhole at the rest area. The resources at the university, in order to get the equipment required to do this kind of chemistry. The piece of machinery that we use is $500,000. It's a shared a piece of equipment because it's so expensive. So you have to coordinate all that timing and testing. And we're also bringing in data from different sources. So we coordinated with our what's called a prescription drug monitoring program. Every state has one of these. Whenever a controlled substance let's call it an opioid like Percocet if you get dispensed or if you get

prescribed a Percocet, it goes into a state database. And that's for everybody in the whole state. So what that allows us to do, as wastewater epidemiologist says, when we see opioid concentrations in the wastewater, we can actually subtract out what we think is quote unquote, normal prescribed use in order to understand, like what the baseline levels are in that community or that county, let's say. And then if we see if we see differences above that baseline, then we start to think, okay, well, maybe there's something else going on here than what you would expect medically. In order to do that, we have to coordinate with our prescription drug monitoring program to get that data. So even on the data side, there's a lot of agencies that were providing us information. There's an agency that does transportation research, and they actually count every truck that comes through one of those truck stops. And they gave us data so that we could match it to the number of people that we were estimating were coming through there. We can compare it to the number of trucks that were being counted. So all of that ordination is required. And ours was a pretty small project. Kentucky is not a huge state. Even the number of sites we had going in like 6 or 7. But in order to do this nationally, you'd have to scale that way up. But that's that's one of the benefits of doing at a wastewater treatment facility, though. We're doing kind of unusual off site type things, rest areas, truck stops. Nobody's done that. If you do it in a wastewater treatment facility, they're kind of already geared up for getting those samples because they're doing it for like the Environmental Protection Agency and other agencies that are monitoring wastewater. That's the idea, is that eventually you'd get this kind of thing going at wastewater treatment facilities around the country.

Lawrence Mullen [00:29:58] Can you tell us more about some of the outcomes from the projects and things that you've seen?

Chris Delcher [00:30:02] One of my favorite outcomes of this study has been our ability to find this drug called xylazine. I mentioned it a little bit earlier. It is a drug that historically has been used to sedate large animals, and for whatever reason, it has made a an appearance now in the drug supply, in the illicit fentanyl drug supply in the country and in particular, places like Philly are really hard hit with this particular drug. Why is it so bad? Well, in addition to it being mixed in with fentanyl, which is obviously extremely dangerous for people who are using street drugs, it causes these really nasty skin infections. And there's an additional level of not only the effects of an overdose from fentanyl, but now you've got people walking in with these infections that very often could lead to amputation. And it's just really a challenging and different scenario for health care providers in particular, why it has hit so hard recently. By recent, I mean in the past 3 or 4 years, I'm not exactly sure, but it is a drug that if you're not looking for it, you're not going to find it. Which makes sense, right? So what we found is that if somebody comes into an emergency department in Kentucky, there's a set of drugs. If you order the labs, you're going to be looking for those particular drugs. And, you know, you can imagine it's the cocaine's, the heroin's, the methamphetamines, you know, that kind of stuff. The more exotic, quote unquote, drugs. You may not have those on a standard test yet that's. That's what we found in Kentucky. So we started to ask the question as we started to see these hot spots around the country for xylazine we started to ask ourselves, well, where is it in Kentucky? And we couldn't really find any evidence of it in the health care system. And it wasn't something that is typically tested for by our coroners. So many of our neighbors were starting to detect and raise alarms about xylazine. We didn't have anything going on in Kentucky, and that just didn't seem right, because Kentucky, historically, because of the Appalachian part of our state and, you know, crossroads that come through the state, it's been a hot spot for almost every type of drug that you could imagine. So it just didn't make any sense to us that we weren't seeing it. So we thought, let's gear up, let's get a test for it in the wastewater and see what's going on. And sure enough, we found it, and we found

that it was correlating to increases in what was being tested for by law enforcement when they made seizures of drugs on the street. There's a system that tests for what types of drugs are in there. We were seeing an increase in xylazine positive law enforcement submissions that we're seeing, an increase in xylazine positive wastewater samples. So that was really proud of that, because that's exactly the spirit of what we are trying to do to demonstrate why wastewater could be really valuable in the absence of some of these other traditional drug surveillance systems. That's just one example of one of the outcomes. Beyond that, we're also just reporting out the more standard trends. By standard, I mean the drugs that people are probably more familiar with. We've got results on on what those look like in the rest areas and the truck stops. And we're comparing the two because the rest area gives us like a sense of the general population. And then the truck driving population is more specific. One of the outcomes we found in the truck driving population was a pain medication called tramadol. And so everything I've been talking to you about, I've been kind of mentioning the illicit drugs, but we're also testing for pharmaceutical drugs that you would get as a prescription. So tramadol is one of those drugs. It's used quite frequently in populations that experience pain. And so we expected that the truck driving population is a population that through time is probably experiencing pain and higher levels than the general population just by the nature of the job. And we could see that their use of tramadol was higher than the general population. So that made sense. Now, is that like groundbreaking? No, but demonstrates that you can use the wastewater to get to a drug use pattern that makes sense in the real world. And that's important for the science, for people to then trust the wastewater, to say, oh, yeah, it's able to show us these drug use patterns without us having to do a survey of every truck driver in the country and ask them, do you use tramadol, yes or no, that kind of thing. So that that was an important outcome.

Lawrence Mullen [00:34:45] We are getting closer to the end of our time together. What type of advice would you have for other organizations that may want to implement wastewater epidemiology?

Chris Delcher [00:34:54] How can we wrap this up with a car metaphor again? So we're bringing it into the driveway. Isn't what we're doing here okay. Advice to other people? Well, I think it's important to take the two words we've been talking about, which is wastewater epidemiology. You need to have a wastewater expert, which is typically a chemist, and you need to have an epidemiologist working together. Right now, there's a lot of this work that is going on the chemistry side because it's very complicated. You can imagine all the junk that's mixed in wastewater. It's very hard to deal with that from the chemistry perspective. So a lot of this science right now sitting in the chemistry world and the chemists don't necessarily understand the public health applications or implications or how this data can be used for public health or public safety. And that's where the epidemiologists come in, and that's where they can also triangulate some of that data. We talked about the prescription drug monitoring program data and how as an epidemiologist, you think about, well, what's the normal baseline use of this drug in the community, you know, and does the wastewater do something different than the baseline? So those are all concepts that epidemiologists are trained to think about. So I think that collaboration is critical for any project like this. You know, if NIJ wants to do more of this, then bringing in the public safety side of this a bit more as well would be critical and understanding how law enforcement could use wastewater to their advantage. I mentioned evaluating big operations and whether or not they were successful from that perspective.

Lawrence Mullen [00:36:30] What do you think is next for you on this project?

Chris Delcher [00:36:32] For me, I would love to continue to be an epidemiologist involved in this type of project. I don't want to be in the manhole. I don't want to be collecting the sample. I'd love to see this shift to a place where the real experts on collecting this at the like, the wastewater treatment facilities that are more engaged. That would be wonderful. They have their own full time jobs and and often the science part of this kind of gets worked in when you can. But I'd love to be thinking more about all of the applications. How can we catch up to countries like Australia? They've got a network set up around the country and they're they're just pushing out reports, epidemiologic reports. How does the wastewater compare to what we typically use, like the National Survey of Drug Use in households? That's usually the big national survey that tells us what the big trends are. How can we get wastewater at that level? So that's where I want to spend my time thinking, crunching the numbers at this point and looking for opportunities to do that, which if any federal agencies are listening, they know where to find me. Again, there's not a lot of funding out there for this type of work that I'm aware of, partly because it's still trying to prove itself, but I really am grateful to NIJ for taking the chance on a project like this. We've presented it to the director, we've presented it to, representatives at the Office of National Drug Control Policy and everybody really, I think they see the value of what we're doing. There's some federal coordination around wastewater epidemiology that I know is happening to understand how to deploy this. So that's good news. I'll stay on that front as much as I can and and hope that the car doesn't stay locked in the garage.

Lawrence Mullen [00:38:20] I genuinely enjoyed this conversation with you today, doctor Delcher, I just like to thank you again for sitting down today with Just Science to discuss your NIJ award on wastewater epidemiology. And again, just thank you so much, Doctor Delcher, for your time.

Chris Delcher [00:38:33] Thank you for having me and hopefully I'll be back one day.

Lawrence Mullen [00:38:36] If you've 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 forensic field, visit forensicCOE.org to request training and technical assistance or learn about additional resources from the COSSUP TTA collaborative visit COSSUP.org. I'm Laurence Mullen and this has been another episode of Just Science.

Introduction [00:39:04] Next week, Jason sits down with doctor Nabarun Dasgupta and Erin Tracy to discuss drug checking in the UNC Street Drug Analysis Lab. 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.