Paramita Chakraborty

Welcome to Tech Advantage. Wastewater surveillance and it's use in determining the status quo of a health situation gained particular prominence during the COVID 19 pandemic. It has proven to be an effective tool for gathering timely and valuable intelligence, regardless of people's behavior, such as their willingness to get tested, for example, and interventions such as the implementation of containment measures.

What does wastewater monitoring involve? Could such a surveillance mechanism help predict the next pandemic? We have Dr Leslie Ogorzaly with us today to talk us through these questions. Leslie is a senior researcher within the environmental research and innovation department at LIST. She was part of the CORONASTEP project, which is responsible for monitoring the evolution of the COVID-19 virus in Luxembourg's wastewater. Welcome, Leslie to Tech Advantage.

Leslie Ogorzaly

Thank you.

Paramita Chakraborty

Great to have you here.

Leslie Ogorzaly

It's a pleasure also for me to be here with you.

Paramita Chakraborty

Thank you. So, wastewater surveillance, when we think about it, I mean, as lay people, you know, we always think of gory things, you know, what, what are we supposed to look at, what does it involve, I mean, from a scientific point of view from a researcher? So, what exactly does wastewater surveillance or monitoring, what does it mean?

Leslie Ogorzaly

So, the wastewater-based epidemiology, it's the fact to use the urban wastewater, to evaluate or to determinate the circulation of some pathogens in the human population. So basically, you just have a look at your toilet water just to know if you have some pathogen, viruses or bacteria currently circulating in the population. But the concept can be also extended to some other molecules, because you can also use wastewater surveillance, to have a look on for example molecules like medicines or also illicit drugs. So, it also allows to keep a pattern, to get a pattern of the behaviour of the population.

Paramita Chakraborty

So, when you're saying that you have to look at the toilet water... So, in layman's terms, how does it actually come about? I mean, the scientists, they go to the... where do they go and collect the water? What do they do basically?

Leslie Ogorzaly

So, for that you go directly at a wastewater treatment plant. And you take some, water sample at the inlet, at the entrance of the wastewater treatment plant. So it's water that didn't have any treatment.

Paramita Chakraborty

So just in its raw form, and it's picked up and that's taken to the...

Leslie Ogorzaly

Yes, it's picked up using a kind of automatic auto sampler. So it's just an equipment that allows you to take some samples of water, every hour, and thus you get a complete sample from 24 hours.

Paramita Chakraborty

So, we have been hearing about wastewater monitoring quite a lot during the last three years, especially during 2020 and 2021. But has the concept been in practice for a long time? How did it start?

Leslie Ogorzaly

Yes, it is. In fact, it's really something, known or proposed, since very long time. But for the moment, the authorities and especially the health authorities have not really understood the interest of this methodological approach. But it was already proposed, more than 10 years ago, for the surveillance of polio viruses. It's really the method recommended by the WHO to follow the polio viruses also in the population.

Paramita Chakraborty

For polio viruses, how was it used? How was the wastewater monitoring used?

Leslie Ogorzaly

It's a little bit different for the polio viruses because the WHO recommend to use the surveillance of environmental waters because it's more in a geographical area where there's not necessarily a wastewater treatment plant, because it's mostly in low income countries. And in this case, it's more monitoring of the environmental water such as, mainly the surface water that can be also contaminated by faecal material.

Paramita Chakraborty

And so, what is the importance of this kind of monitoring especially in the context of the pandemic?

Leslie Ogorzaly

I think that in the context of the pandemic, maybe the most important advantage of this approach is that it's an unbiased approach. It is not influenced by, for example... there's a number of tests of the population, so these have no impact on this method. And also, you get really an overall picture of the population because you have access to people that have symptoms and also some people that do not have symptoms because there were a lot of also a-symptomatic carriers of the virus. And so, with the wastewater, you have a complete picture, a more real picture of the circulation of the pathogen. Today, for example, we are really in a phase where the wastewater-based epidemiology is very, very useful and very important for the health authority because there are no more testing of the population. And now, the wastewater data, it's more or less the only one that the health authority can have to just to have a look on the circulation of the virus, and also to take some measures or some restriction maybe in the future.

Paramita Chakraborty

But what I can say is that the CORONASTEP report that is published every two weeks on our website, it is actually quite rigorously followed by some members of the population. Because I remember we received an email from one of our readers, when there was probably a gap in the publication, I don't remember exactly when... it was a few months back. Which means that there is this... And the person said that they were vulnerable, they were part of the vulnerable population, who actually gave a lot of attention, and read attentively the report to see what is the status now of the virus in the wastewater.

Leslie Ogorzaly

Yes, especially because right now, the health ministry doesn't continue to produce some data coming from the population, because there is not enough representative testing. So yes, it's one of the only ways to follow the evolution of the virus.

Paramita Chakraborty

And how does it work? If I ask you as a as a lay man, how does it work, basically, to discover the pathogens or to see the evolution of the virus or to determine... because after a certain point of time, we were able to also determine the variants, right?

Leslie Ogorzaly

Yes, it's right. We are also able to detect the variants in the wastewater. Basically, when the wastewater sample arrives in the lab, you have a complete process or workflow to prepare the samples with the objective to get the viruses that are inside samples, it's really the first step. It's really the most critical step because it's really difficult to separate the viruses from the wastewater. So, it's the main step. And after... it's a kind of a small filtration system more or less basically, you can make some kind of a filtration to collect only the viruses and to remove all the other materials that are not interesting for us.

Paramita Chakraborty

Probably a very naive question, because I don't know exactly... are the viruses still alive?

It depends. For the COVID-19, you can be pretty sure that the viruses have been inactivated in the wastewater. It is no more infectious. So it's not necessarily destroyed completely, but normally if you get in contact with the wastewater, it's not possible to catch the illness by the water vector in this case. For some other pathogen, yes, they can be still alive in the wastewater. It really it really depends.

Paramita Chakraborty

It depends on the...

Leslie Ogorzaly

It depends on the characteristic of the pathogens.

Paramita Chakraborty

So, for the scientists, there is no risk of catching the virus...

Leslie Ogorzaly

There can be some risk to work with the wastewater, especially in this case, when you work with raw wastewater without treatment. But you have all the lab equipment and the facilities that allow us to use this kind of sample and also to protect ourselves from the risk.

Paramita Chakraborty

So, wastewater surveillance, particularly at LIST, has been a very important factor, let's say a very important research area in the CORONASTEP initiative, right? So, can you tell us a little bit about how it came about?

Leslie Ogorzaly

So, at the very beginning of the pandemic, when you know -- because it's not necessarily something really known at the beginning -- when you know that the viruses can be found in the stool of the impacted people, we decided to go directly to the wastewater treatment plant to have a look and to see if it's possible to detect it in the wastewater. Because at the moment of the emergence of the pandemic, we already had a project dedicated to wastewater surveillance, because it's not something new for us. And so we already had a network of wastewater treatment plants where we regularly sample the water, where we just go to check if it's possible to detect the virus in the wastewater.

Paramita Chakraborty

So that was really the beginning, actually?

Leslie Ogorzaly

It was really the beginning. I think it was in the middle of March 2020.

Paramita Chakraborty

And was it something that was asked by the government to LIST?

Leslie Ogorzaly

Absolutely not. No, no, it was our initiative at the beginning just to have a look. And we also had some discussion with some colleagues in the border countries, in the Netherlands, in Belgium and also in France, to also have a look at the wastewater at the same moment. And we had very important exchanges with different colleagues from Europe, to put in place the good protocols and then to proceed. At the beginning of the pandemic, there was the National Taskforce also in place in Luxembourg. And in this context, we also developed collaborations with some other institutions of Luxembourg, for example, the Luxembourg Institute of Health, but also the Laboratoire national de Santé and also the University of Luxembourg. And we also worked together to put in place the wastewater-based epidemiology, for example, at the beginning we also got the PCR protocol from the LIH. And we also had a huge collaboration with all the wastewater syndicates because all the sampling of the water was done directly at the wastewater treatment plants by the staff in place. So we were not in charge of this task. So, we had a huge collaboration with different actors in the water sector in Luxembourg.

Paramita Chakraborty

And now, all the research that is going behind the wastewater monitoring, are you still collaborating with these entities?

Leslie Ogorzaly

There is still ongoing collaboration with Luxembourg Institute of Health in the framework of the VIRALERT project... it's more on the extension of the wastewater surveillance to the environment.

Paramita Chakraborty

I can understand that it was CORONASTEP, and wastewater in general was a way to figure out whether or not... or how much of the virus is present in a country, right? But how were you able to then determine all the different variants?

Leslie Ogorzaly

For this part.. it really occurs in the detection part. So, we use a PCR, exactly the same as for the human testing of the population, we use the PCR, its molecular detection tools, and you are just looking at a small part of the genome of the virus. And you have some specific PCR detection techniques that are able to distinguish specifically one variant from another one. It's just the design of the PCR itself that allows the detection of the variant. But for that you need to know the sequence of the new variant. So, it's really difficult to anticipate the detection. So you really need to know the variant and to have the genomic sequence before.

Paramita Chakraborty

Are scientists able to... is there a way to predict a pandemic or predict a great epidemic from wastewater surveillance?

Leslie Ogorzaly

It could be for sure a great opportunity if we succeed to do that but it's not so easy in reality, because you never know which kind of pathogen or which kind of viruses will emerge in the future. So in most of the detection methods are targeted methods where you have to know the pathogens from before and if we have something completely new that emerges in the wastewater, we have no real means to detect. So, for that, for the moment, in some of the projects, we are working also on the use of sequencing just to know if we are able to detect something new using this kind of technology. But for sure, we need to pass through very complicated sequencing methods to perform this kind of prediction.

Paramita Chakraborty

What are the protocols that are there? In the sense, are there any, especially after the pandemic and especially how effective wastewater monitoring has been to detect the variants and you know, to test the population for the Coronavirus, are there currently any sort of protocol in Luxembourg? Or in the neighbouring countries or beyond to have this kind of continuous research?

Leslie Ogorzaly

Yes, based on the success of the CORONASTEP project, we are in discussion already with the health authorities, because the health authority is very, very interested about the wastewater monitoring, and really understands the value of such an approach. And now, we work closely together to

implement in Luxembourg a permanent surveillance system based on the wastewater. So, we are currently working on the establishment of a real wastewater surveillance system.

Paramita Chakraborty

And outside of Luxembourg?

Leslie Ogorzaly

It really depends on the country. Because for sure, in Luxembourg, we have been really lucky because we have great interest from the authority. It's not necessarily the case in other countries in Europe, but for example, I know that in France, there is also a large surveillance network named Obépine, that it's also now to going to a more routine phase with the support of the French government for the surveillance based on wastewater.

Paramita Chakraborty

And finally, maybe what is the next step, in the sense what kind of new innovative research is going on in this field, in the field of wastewater monitoring?

Leslie Ogorzaly

For example, following the CORONASTEP project, we have defined a series of of projects, it's kind of a follow-up project of CORONASTEP. And we now work, for example, to integrate also, data coming from the environment and not necessarily from the wastewater only. Because you know, it's pretty sure that the next pathogen that will emerge, will come from the animal reservoir, and not from humans.

Paramita Chakraborty

What does animal reservoir mean?

Leslie Ogorzaly

It's already the same for example, for COVID-19, at the beginning, the virus came from bats, and for most of the infectious diseases, at the beginning, the reservoir is always an animal. So, the viruses circulate first in animals and then go to humans. And so, for that, and also to monitor and to survey the animal reservoir, so you want to use the environmental water, so principally, some ponds, also surface water, to track and to see if you have some emergence also in the animal population, and not only in humans.

Paramita Chakraborty

OK, so that could give us an early sign probably of a virus.

Leslie Ogorzaly

Yes, also to have a more complete picture, because human health and animal health are really closely related together. So, you need to have a look at both.

Paramita Chakraborty

We know that there is some other pandemic, or some other epidemic is lurking, probably...

Leslie Ogorzaly

Yes, for sure. A next one. When we don't know that.

Paramita Chakraborty

Yes, it's just a matter of time. Probably. So good luck. Good luck to you. And to your team for keeping us safe. And thank you so much, Leslie, for having been here.

Leslie Ogorzaly

Thank you so much also for giving me the opportunity just to explain a little bit more what is wastewater surveillance. Thank you.

Paramita Chakraborty

Thank you so much, Leslie. See you!

So that was Dr Leslie Ogorzaly talking about wastewater monitoring, the very useful and unbiased method for detecting viruses early in a population. As mentioned by Leslie, the environmental microbiology group at LIST has been tracking wastewater viruses for more than 15 years. The work of LIST coupled with the data collected in samples of human excretion by the Laboratoire nationale de Santé has provided a better understanding of the circulation of viruses such as noroviruses or enteroviruses responsible for a wide spectrum of benign or even serious symptoms like hand foot and mouth disease, angina, respiratory disease, or even meningitis. So, the next time you hear the term wastewater, you'd know that it's much more than just water flushed down the drain. With that, we come to the end of this episode. Don't forget to follow us on our social networks and see you in two weeks.