Make Me Care About...
Make Me Care About...Wastewater
Podcast episode eleven transcript

Jen Hatmaker: Welcome to Make Me Care About, you guys. This is a good one, one that I was really looking forward to, because I don't know what image comes to your mind when you hear the word surveillance, but I thought, is someone spying on us? Is someone spying on our poop water? What's happening? And so I was super looking forward to having this conversation and I can tell you with confidence, no one is spying on you.

Created in partnership with the Bill and Melinda Gates Foundation, this is Make Me Care About, I'm Jen Hatmaker and with me is Supriya Kumar, a program officer working on infectious disease surveillance at the Gates Foundation. I'm delighted to meet you. You're such a fascinating person. Your work is so interesting and specific.

Supriya Kumar: So I am a molecular biologist by training and then retrained in public health, and what I do at the foundation is really focus on infectious disease surveillance. And so, there's many ways to do infectious disease surveillance and typically you would rely on somebody who has symptoms of a disease to come into a clinic and then be tested by a healthcare professional. And that's great. I think that is absolutely important. In addition, there is new methods that are being developed that allow us to also look at what is going around in a community's wastewater. And what I mean by that is that we're realizing that a lot of these diseases that are caused by specific pathogens, those bugs, pathogens, are also shed by humans who are infected with them. And by shed, I mean when you poop, you actually send some of that pathogen out into the sewer. And so even if you didn't go into a clinic, you would be able to understand what bugs are transmitting in the community by looking at what's going around in sewage, and so that is what wastewater surveillance is.

Jen Hatmaker: So why should we care about this? What is potentially at stake if we don't pay attention to wastewater?

Supriya Kumar: Yeah, there's two aspects to this. One is if you do rely on people going into the doctor for us to be able to capture these diseases in our surveillance systems, you are going to miss a piece of the picture because there are populations that are wary or accessing healthcare. There are populations that simply don't have access and so cannot go in and access healthcare, and so you're going to only see a biased picture in your surveillance system unless you have this kind of method that is independent of human behavior. I think it gives people sort of situational awareness and important information that might not be available through a traditional healthcare-based surveillance system. And this ties into the second point, which is equity. Because you're able to have a picture of populations that don't have access to healthcare, you do have a more equitable

surveillance system with wastewater surveillance, and that's both at our level in cities where you now have a picture of populations that are not going into healthcare setting, but also on a global scale, and so having lower-cost methods such as this can be really cheap.

Jen Hatmaker: Can you give us an example of what kind of diseases scientists have found as a result of wastewater surveillance in the US?

Supriya Kumar: There was a story from last year of poliovirus being picked up in the New York City sewers, and that brought polio environmental surveillance, which we think about and do a lot of globally, really close to home. And more routinely, I guess, the United States did fund and do a lot of SARS-CoV-2 environmental surveillance during the pandemic, and originally during the pandemic, we really wanted to understand does a community have SARS-CoV-2? It was very early days and you didn't even know if it had spread everywhere, and so wastewater surveillance gave you an early picture. As you progressed through the pandemic, it became an early warning system and the United States has quickly become really quite a leader in this space. The CDC has taken up waste water surveillance in many counties around the country. So for example, influenza we know spreads seasonally in the United States and it does mutate routinely. And so by looking at wastewater, you can start to get a picture of the particular virus going around in a given year.

Jen Hatmaker: That's so interesting. Could you drill down one more layer and just explain to us how scientists like you actually surveil wastewater? Walk us through the process.

Supriya Kumar: It's the exciting art of going and picking up sewage.

Jen Hatmaker: That's what it sounds like.

Supriya Kumar: No, seriously. So there are many ways to do it, of course, and it all depends on the context. So in high resource settings, there are sometimes robots that are used, so you can have a little robot that sits in a sewer and sips. That is really the term that is used.

Jen Hatmaker: Oh my.

Supriya Kumar: It sips sewage every once in a while, so you have a little bit of sewage that is picked up every once in a while over a day. And so for that 24-hour period, you can have a composite sample and then you can look at all the pathogens that you find in that. That's the most hands-off approach. But even so, you need to go and pick up the sample from that robot, take it to a lab, and then extract the information that you want to find over there. The more hands-on method which is done even in the United States and in

high resource settings is to go and actually pick up a bucket of sewage and then take it back to the lab.

In lower resource settings, it is typically either the bucket approach or there are extremely low-cost methods that are very efficient, that act very much like that sipping robot, but essentially what you're doing is take a gauze, a piece of gauze, tie it up and put it in your sewer for 24 hours. And so as the sewage flows through it, your pathogens are captured in this cause material. And then you can go back after 24 hours or 48 hours, pick up that goal, bring it back to your lab and assay it. So there are various methods you can use based on the context and how much money you have to deal with it, but that's the approach that's taken to actually sampling your wastewater or sewage or septage system.

Jen Hatmaker: I think it's going to take me a solid week to get over the phrase sipping sewage. Just give me some time. Give me a minute, I'll get there, but it will not be quick. So let me ask you this. What are some, or maybe are there other surprising places that we wouldn't necessarily register as places to track viruses outside of that obvious space?

Supriya Kumar: Yeah, we're on an aircraft, we're not necessarily thinking wastewater collection on the aircraft.

Jen Hatmaker: Yeah.

Supriya Kumar: But it is interesting. Most of these Boeing and Airbus aircraft will have three wastewater collection tank, and you can look in those tanks to see what are people on this flight shedding. But along the same lines, there are other transportation networks. In many countries, it's not aircraft that most people would travel on. For example, there are countries right now that are thinking about doing some surveillance in border towns because that's where migrants are going back and forth, and you might be able to get an early warning of a pathogen either coming in or going out. During the pandemic, what became quite useful was the ability to also surveil at university dorms. Because surveillance of wastewater was such an early warning system, especially in those kinds of closed settings where you might know who all live in this place and as soon as you pick up a signal of a pathogen, you have an intervention that can increase either individual based testing or you can increase vaccination, that became really powerful.

Jen Hatmaker:

This is Make Me Care About. I'm Jen Hatmaker and with me today is Supriya Kumar. She is a wastewater surveillance expert and public health researcher at the Gates Foundation. You guys, today, Supriya is telling us all about the power of wastewater surveillance. I don't know about you, but I can tell you I'll never forget the term sipping sewage again, so don't tell us we never taught you anything around here. In the second half of this conversation, we've got some really cool stuff. Supriya's going to talk to us about barriers to wastewater surveillance that exist in other countries, what people like me and you can

do about any of this. And also the future of pandemic preparedness. What have we learned and what might we get better next time?

This is Make Me Care About. I'm Jen Hatmaker and with me today is Supriya Kumar. She is a wastewater surveillance expert and public health researcher at the Gates Foundation. So Bill Gates wrote an op-ed in the New York Times recently, and I'm just going to paraphrase. He basically said, imagine that you are in your home and you have a little kitchen fire, and so several things are in place to solve this. First of all, your fire alarm goes off. Somebody calls 911. That's in place. You reach under your cabinet and you grab a fire extinguisher and you start working on it. That's another precaution that you had ready to go. If that doesn't work, we've talked about this a million times, you know how to safely evacuate. By the time you guys get outside, there's a firetruck, there are firemen, there is a water hose. They know where to hook it up. They use the hydrant. And just like that, the fire's put out of your home before it affects your neighbors or the whole street.

So he goes on to use that analogy to say that we need to prepare to fight disease outbreaks in the same way, meaning we need to have a bunch of systems in place that are universal and ubiquitous because with a pandemic, it starts in one home, as the analogy goes, but it very quickly spreads to the whole street and then the whole neighborhood. Is this how you think in terms of wastewater surveillance on a global scale? Because there is one way to look at it, localized and country to country, but there is great need obviously precedence for paying attention to this on a global scale and having some sort of concerted effort around early detection and then response. I'd love to hear your thoughts on that.

Supriya Kumar: Yeah, I think it's both. So you do need that global networked approach and people need to see the value of that for their country. You need countries to be bought into that system together and know that they will reap the benefits of whatever comes out of it. So think about, for example, if the next pandemic potential pathogen came out of a low resource setting, a setting somewhere in Africa or South Asia, these countries may not necessarily have the resources to undertake wide scale surveillance or even know which part of their country this has arisen in. And so by undertaking aircraft wastewater surveillance, if a country like the United States saw there's this pathogen that's arisen in some small country, what do we do about that?

I hope that we will be, by the time the next pandemic comes around, and it will come around, I hope we'll be at a stage where we don't have to just shut air travel down and flows off that country. I hope we'll be at a place where the world is willing to say, "Oh, it's coming from this country. Let us see how we can help that country deal with it. How can we increase surveillance in that country? How can we make sure that whatever vaccines are made are actually available to that country and early?"

Jen Hatmaker: What are the primary barriers for a lower resource country or community to say, "We simply can't do this?"

Supriya Kumar: Yeah, it's a really interesting question. It's probably easiest to explain in relation to a higher resource setting, so how is it different? So when you think about a city in the United States, I'm in Seattle, you can go to my wastewater treatment plant and ask the managers there, "How many households are connected to this plant?" So if I were to sample at this plant, how many households and how many people even does that represent? And you would have that information immediately. The first step in setting up this kind of surveillance system in a lower resource setting is in fact estimating the number of people that are represented in a sample that you take from that river. And that itself takes a lot of resources, more resources than it takes to simply get that quick information from the wastewater treatment plant in the United States. And the pathogens that are of interest in a lower resource setting might be quite different from what are of interest here.

So here, people are interested in a lot of influenza and SARS-CoV-2. In lower resource settings, there is often an interest in things like cholera in typhoid, of course polio, so there's also a challenge in coming up with the tools to look for those pathogens of interest. And if those tools are significantly different from what is of interest in higher resource settings, those tools need to be developed. As the global community, we would do very well if we all collaborated on developing those tools because who's to say when those pathogens won't hit our shores?

Jen Hatmaker: So using the analogy and knowing what you're teaching us about the immense value of wastewater surveillance, everyday people like us who aren't in your line of work, is there anything that we can do to support the firefighters, such as the analogy goes, who would work together to [inaudible 00:15:24] out the spread of another pandemic?

Supriya Kumar: Yes. I like to think about wastewater surveillance as in some ways democratizing the availability and use of data. It gives us, I think, as people in these communities, the power to take health into our own hands and to really change our own behavior based on what we are seeing in wastewater. I can decide to wear a mask for the next week if I see increasing trends in my community. I can decide to work from home for the next week if I'm able to, if I'm in a position to do that, and if I see that that would be useful in my community. So I think in a way we as everyday people with wastewater surveillance are more powerful. Given that knowledge, I think we could also advocate for more wastewater surveillance and advocate for more funding for wastewater surveillance.

More broadly, I think at the global level it's a very powerful method, and so keeping track of what people are doing with it is also very important. With a powerful method comes of course the potential for it to be misused. For example, we at the foundation and I in public health generally would like to keep this method be focused on public health use. We would like public health authorities to have access to these data and for the public to have access to these data, but it is not outside the realm of imagination for companies to start surveilling their effluent systems to try and understand what's going around in your

employees. So I think that we need to keep track of also the ethics of how this is done and managed, and it's on all of us to do that.

Jen Hatmaker: What do you think your work can teach us about future pandemics?

Supriya Kumar: There are many ways that it could be useful. The most top of mind I think from the COVID experience is this early warning system. There is also, in parts of the world, there are no diagnostics that are used for some pathogens, and so you don't even know if that pathogen is a problem in your community or in your country. And when there are vaccines that are available that can really improve the quality of life of people, you want country policy makers to know whether that disease is a problem or not. So we can develop the tools to actually understand, and these will be lower-cost tools than actually doing diagnostics in individual. So we're doing this, for example, for typhoid in various spots of Africa and Asia.

And then there is also genomics, so understanding not only if a pathogen is present or not, but also exactly what form it's taken. So we're hearing a lot about avian flu of late, and it has started to really spread in wild birds and it has already started to jump over into mammals, but really starting to understand what form is that virus taking, how is it evolving, how is it starting to adapt more to humans or not is really useful. And we do have the tools to use wastewater surveillance in that way as well.

Jen Hatmaker: What would you love to see in a best case scenario as you look to the future of wastewater surveillance?

Supriya Kumar: I would love to see the world be a bit more coordinated and come together, really. When you think about healthcare systems being as varied as they are around the world, and people's access to healthcare being as variable as it is, developing a global early warning system is not an easy task. But I think the potential exists with wastewater surveillance, and so it is hopeful, and that is going to take not only funding, but also the willingness for partners to work together, funders to work together, academics to work together, as well as practitioners and people who are on the ground.

Jen Hatmaker: And there you are out there on the front lines, leading the way. That's exciting. And I hope that in 10 years, if you and I hopped back on the phone again, that we will have seen some big strides forward-

Supriya Kumar: Oh, yes.

Jen Hatmaker: ... in all the ways that you just mentioned. I really would love to see that in our lifetime, knowing that this could be incredibly preventative for another pandemic. It's a huge deal and this is a huge space, so thank you so much, Supriya, for being here today,

and you officially made me care about wastewater surveillance and you taught me the invaluable phrase of sewage sipping. Who else could do it but you? You did it.

Supriya Kumar: Very good, Jen.

Jen Hatmaker: Thank you.

Supriya Kumar: It's been a pleasure. Thank you.

Jen Hatmaker: It's interesting, I'm walking away from this conversation feeling strangely hopeful and realizing that we really are truly connected globally and that we matter to each other, that we belong to one another. And so I hope that the next time Supriya and I talk, that the world looks a little bit different, a little bit better than it did today. If you are interested in learning more about Supriya's work, you guys, check out the show notes.

Make Me Care About is produced by Jesse Baker and Eric Nuzum of Magnificent Noise. Our production staff includes Sabrina Farhi, Hiwote Getaneh, Julia Natt, and Kristen Mueller. Our executive producer is Eric Nuzum, and I'm your host, Jen Hatmaker.