

## **2-6 National genome surveillance for antimicrobial resistance**

[00:00:16.27] So my name is Iruka Okeke. I'm a professor at the University of Ibadan in Nigeria, and I work for the Nigeria Centre for Disease Control in AMR surveillance. When we started the process of setting up the Nigeria's AMR surveillance system, we used the template that is provided by the WHO. WHO requires that every country that has an antimicrobial resistance surveillance system has at least one sentinel lab, and has a national reference lab, and has an antimicrobial resistance coordinating Centre.

[00:00:53.68] The Nigeria Centre for Disease Control serves as our coordinating Centre. We started off with just three sentinel labs. We continue to grow the system today. And for our national reference lab, initially we examined the sentinel lab options that we had and selected one of them to act as a national reference lab. Because that lab didn't have all the resources to be able to serve as a national reference lab, it was very important to twin the national reference lab function with a new genomics function that provided those facilities.

[00:01:36.96] In terms of how the technology, and in particular genomics technology, helps us to set up the surveillance system. So we found ourselves in a situation where we had sentinel labs that could serve as a surveillance system. And we had a very willing coordinating Centre. But we didn't have a lab that could perform all the functions that a reference lab needs to perform.

[00:02:01.23] So what we did essentially was use genomic science to leapfrog over having a lab that does phage typing, serotyping, a lot of technical methods that are used to type different bacteria. Because genomics can actually subtype bacteria of all different species. So we're able to just set up one genomics lab that provides functions for many different pathogens.

[00:02:32.48] We gave a lot of thoughts before introducing genomic technology for AMR surveillance in Nigeria because we realised that it was a bit costly. We realised that we needed high tech expertise, particularly in bioinformatics. But in actual fact, those were not the hardest things to do. We were actually fortunate to be able to get extramural support from the UK NIHR, National Institute for Health Research and Care, that allowed us to bear the costs of setting up AMR surveillance. And we were part of a network that provided training for the scientists that were going to do the genomic sequencing and the bioinformatics.

[00:03:15.83] However, the challenges that we did have, and are still actually grappling with, include being able to get consumables. It's actually very, very difficult to get some of these consumables on a regular basis in Nigeria. Getting servicing for equipment is also a bit of a challenge. And for us, we have a lot of infrastructural challenges. For example, electric power is not on all the time. So we had to build quite an elaborate electricity backup system because the sequencer, for example, must never go off. And so this was another challenge that we needed to deal with that may not be the case in every country that's trying to introduce genomic surveillance.

[00:04:07.76] So in Nigeria, we're actually very fortunate that our Nigeria Centre for Disease Control actually is set up to work very well with academia. It recognises that we have a lot of expertise in academia that could be used for surveillance. For example, before we set up our

antimicrobial resistance surveillance system, my group was already doing genomic surveillance with diarrheal pathogens. So we had some of the expertise that would be needed for antimicrobial resistance surveillance. And it made sense to harness this expertise for surveillance.

[00:04:41.02] We, of course, needed to build up some things that we didn't have then. For example, then we were not doing our sequencing locally. Now we are. But I think it really helped Nigeria to, within a very short period of time, have this national reference facility set up because it was using the resources that were already present in academia.

[00:05:00.52] The NCDC now has its own sequencing facilities. But it was able to take the time to build them up. It's able to tap on I and others in academia to provide training and support for its staff. And so I think really working with academia has allowed the NCDC to move very quickly on surveillance of bacterial pathogens and antimicrobial resistance but also a range of pathogens, including viral pathogens, by working with different groups in academia.

[00:05:34.01] So I continue to work very closely with NCDC. NCDC has not yet fully taken the reference lab function. As you can imagine, I mean, when we planned it out, 2017, 2018, COVID hadn't started. So when the COVID pandemic started, it's a lot of pressure on them to get the viral work up and running. And so they spent a lot of time on that. And what we're really hoping with the current grants that we have is that within the next five years, we should be able to shift all the bacterial sequencing to NCDC as well.

[00:06:07.68] But I'm also part of the technical working group that gives advice on AMR more generally. That technical working group is comprised of, I think, 2/3 academics and 1/3 public health people. So even if we're not physically doing the lab stuff, we are still providing an important advisory role. And it's actually really nice for those of us who are scientists-- if you're a basic scientist like I am, you don't imagine that the things that you're doing will be relevant to human life and survival in your lifetime. But when you do and you have this collaboration with your national public health institute, you're able to make an impact while still doing your basic science on the side.

[00:06:53.26] I'll say that, first of all, that sequencing is actually not cheap. It's costly. But for us, it has been very cost effective because it uncovered other things. It helped us do other things that we wouldn't have been able to do if we'd set up our national reference lab functioning in a different way.

[00:07:10.17] For example, now there are questions about which *Klebsiella* lineages should go into vaccines that are in development. Because we're using sequencing to subtype our *Klebsiella* in AMR surveillance system, we already have that information, which we would have had to generate in a different, more costly way. So even though it is expensive to pay for the various things to do whole genome sequencing, it's cost effective because it leads to other things that you would not necessarily have anticipated.

[00:07:40.27] Another example is that we set up originally to focus on the WHO priority pathogens for antimicrobial resistance. We wanted to make sure that we could sequence and provide information for most of the species. And then when we had started sequencing, about a year later, one of the hospitals had an outbreak of *Serratia*. And this is not one of the WHO priority pathogens. But because we're using a method that can be used for pretty much

everything, we were already equipped to be able to investigate that outbreak of Serratia even though it wasn't a pathogen that we had originally conceived.

[00:08:18.23] So I think these are things that resource limited settings should think about when they're choosing methodologies to support their antimicrobial resistance facilities.