

# Global Veterinary Diagnostic Laboratory Equipment Management and Sustainability and Implications for Pandemic Preparedness Priorities

*[Announcer] This program is presented by the Centers for Disease Control and Prevention.*

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Jennifer Lasley, a senior program manager at the World Organisation for Animal Health in Paris, France. We'll be discussing global veterinary diagnostic laboratory equipment and their implications for pandemic preparedness.

Welcome, Jennifer.

[Jennifer Lasley] Hello.

[Sarah Gregory] You work for the World Organisation for Animal Health. Tell us about it—what it is, what does it do, areas it's concerned with, and what you particularly do there.

[Jennifer Lasley] So the World Organisation for Animal Health (or WOAHA, our new acronym) is the global authority on animal health. It was founded in 1924 as the OIE, and we focus on transparently disseminating information on animal diseases and on improving animal health globally so that we can have a safer, healthier, and more sustainable world. We're an intergovernmental organization that works to improve the health of animals and we advocate for sustainable development by promoting safe international trade that fosters collaboration and transparency.

[Sarah Gregory] Your article focuses on management of veterinary diagnostic lab equipment. What are veterinary diagnostic labs typically used for?

[Jennifer Lasley] Veterinary diagnostic laboratories are used for many things—of course, animal disease diagnosis and disease surveillance, but also for the early detection of epidemics or outbreaks, for response to outbreaks and decision making related to the control of those diseases. But they also can be used as biobanks to store important disease strains and information. They participate in the development and production of vaccines and research on zoonoses, antimicrobial resistance, and food safety that are all topics that are important to help us people.

[Sarah Gregory] And how are they different diagnostically from labs for people?

[Jennifer Lasley] Actually, they are very similar, but just handling samples that are coming from animals. So there are some differences, like pathology and necropsy are on a very different scale because some animals can be very, very, very small, or on the contrary, can be very, very, very big. And so, sometimes the scale of those different sections can be much bigger than you would find in a laboratory working with people. And the expertise also that's needed in veterinary diagnostic laboratories needs to have many species, and not just one (not just for people), but for many different species across livestock—cows, pigs, horses, chickens, turkeys, etcetera.

[Sarah Gregory] Okay. Help me here, size...I think of labs as dealing with, you know, like microscopic bits and little, tiny blood samples and stuff. What does it matter whether it's a rhinoceros or a mouse in terms of size in a lab?

[Jennifer Lasley] Because when it comes to the necropsy, often they'll bring the whole animal.

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[Sarah Gregory] Ah.

[Jennifer Lasley] Or they'll bring big parts of an animal.

[Sarah Gregory] I see.

[Jennifer Lasley] So sometimes it's just the reality. I know, like for deer or other wildlife or from zoos, sometimes the whole animal...we would transport it to the veterinary laboratory.

[Sarah Gregory] I see, okay. That explains it.

[Jennifer Lasley] Because maybe they... because maybe, especially if there's an unknown cause of death, they might need to take different types of samples and it might not be easy for the person that's by the animal's side to know what kind of samples need to be taken. So it's just a different scale in some ways.

[Sarah Gregory] I see, okay.

[Jennifer Lasley] Usually they have to have a huge door to be able to bring in the animal carcasses.

[Sarah Gregory] Yeah, I'm seeing now how this could really be a storage issue. Wow.

[Jennifer Lasley] I mean, it's not a huge important point, you know, for the article, but it's just...it's one thing that's different.

[Sarah Gregory] Right. No, just trying to get a vision of the labs itself, right. Why are they important to have, and especially to have working properly? I mean, this might be obvious, but tell us about that.

[Jennifer Lasley] Sure. Veterinary laboratories contribute to our collective public health, and they're especially important when it comes to the detection and diagnosis of zoonotic diseases—so, diseases that affect both people and animals, and can potentially even harm the environment. And so, veterinary laboratories are also critical in antimicrobial resistance and understanding how resistance is developing and moving between animals and humans. They also play a very important role (as we've seen with COVID-19) in emergency response, and of course in preparing for the next pandemic; preventing the next pandemic and responding to it, playing an important role in that way; and also, in biological threat reduction by holding different pathogens that can be highly dangerous or represent a big threat for introduction and disease.

[Sarah Gregory] Are there many of these labs globally?

[Jennifer Lasley] Based on the data that we have in the World Animal Health Information System (or WAHIS), we estimate that there are more than 4,000 veterinary laboratories in the public and academic sectors around the world. But of course, there could be many more than that in the private sector. Also, many of these laboratories might be handling a veterinary function (they might be playing a veterinary role), but they might be housed in other kinds of health laboratories—for example, in public health laboratories, in chemical laboratories, toxicology...all of these different...across different sectors. And so, it's a little bit difficult to know exactly.

[Sarah Gregory] So what role did veterinary diagnostic labs play in the COVID pandemic?

[Jennifer Lasley] Veterinary diagnostic laboratories have used their experience and expertise in very large outbreaks amongst very large animal populations to be able to apply their expertise to

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high-throughput testing capacity—so, PCR testing that we heard so much about during COVID-19. And so, therefore, the different activities and approaches that were used in the testing and surveillance activities for COVID-19 were supported by veterinary laboratories, as much of the testing on human samples also was actually conducted in the veterinary laboratories. But they also donated essential materials to the fight against COVID-19, especially as it related to personal protective equipment, different laboratory and diagnostic equipment, reagents required to run tests, and other consumables where the supplies in the global supply chains were stretched during the pandemic. They also provided human resources and expertise in terms of helping with investigations in different localities and advising when it came to COVID-19 response at high levels—at governmental, local, state, and federal level.

[Sarah Gregory] And what about before COVID? You mentioned WOAHA was established in the 1920s, I believe. But...so how were the labs utilized before that? What kind of things were you looking at and finding?

[Jennifer Lasley] So there are many examples around the world of veterinary laboratories playing a critical role in response to zoonotic outbreaks that have a huge impact on people, like MERS, rabies, avian influenza, viral hemorrhagic fevers such as Ebola...there are many other outbreaks to zoonotic diseases that I could cite. But they also play a critical role in other One Health issues such as antimicrobial resistance and food safety. Also, the role that they play in the veterinary domain itself when it comes to animal health and welfare is also critically important. So the veterinary laboratories provide results upon which decisions can be made related to food security, livelihoods, and poverty reduction. So the veterinary laboratory diagnosis can help the veterinary services can make a decision and to ensure that food is safe for people to eat, that feed is safe for animals to eat as well as drinking water for animals and people, as well as critical things like food security, food safety, and making sure that animals are healthy so that they can make it to market for sale to support the livelihood of many farmers around the world.

[Sarah Gregory] During May through August of 2019, you conducted a global survey to assess the status of veterinary diagnostic laboratories. What prompted you to do this survey and what was your goal?

[Jennifer Lasley] There are many reasons why I decided to conduct this survey. I can recall during one of my first internships early in my career, one of the tasks that I was asked to do was to sow a container of medical supplies to send them to a low-income country that was in need of medical supplies and medical equipment. And I had no experience upon which to do this. I had a catalog of available medical equipment and supplies, and I started to put them into the container in order to fill it up and ship off the container. It was only until later in my career during my fifteen years of experience working specifically in the laboratory sector where I visited many countries around the world and visited many veterinary laboratories around the world, and I always find the same thing. I see several former laboratory units that used to be operating laboratory space that have been decommissioned—so they are no longer benchtop diagnostic space—and now they hold out of service laboratory equipment. And I don't just mean a little space here or there—in some laboratories, whole buildings full of out of service laboratory equipment from over the past 70 years. I've also heard far more anecdotes than I can count about electricity compatibility problems, you know a machine that was purchased in the framework of a project, and it did not work as soon as it was plugged in because the electricity was incompatible. So these kinds of problems working in the laboratory sector, especially if you're

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working in laboratory capacity building or international development, are quite common. And so, my personal experience and the role that I've played at the World Organisation for Animal Health alongside our partners and donors, it has become an important issue to try to tackle the issue of sustainability of national laboratory networks. And so therefore, I wanted to conduct this survey to be able to have real data instead of just these anecdotes from experience. And that real data has contributed significantly to the discussion about laboratory sustainability and the different ways that we can act against waste in laboratory capacity building.

[Sarah Gregory] And what kind of questions were you asking on the survey?

[Jennifer Lasley] We asked about the maintenance and calibration status of critical veterinary laboratory equipment, as well as information about laboratory management satisfaction with the service providers with whom they have experienced who service that laboratory equipment. And we also asked questions about the prevalence of donated equipment in the laboratories.

[Sarah Gregory] How many labs participated?

[Jennifer Lasley] There were 223 veterinary laboratories across 136 countries who participated in the survey. And while the majority of the participating laboratories were from Europe, Asia, and Africa regions, we had participation from every region of the world.

[Sarah Gregory] Is that a pretty good percentage of the number of surveys you sent out?

[Jennifer Lasley] We had 75 percent response from the surveys we sent out.

[Sarah Gregory] That is very good.

[Jennifer Lasley] It's very good, especially for us specifically at WOA. When we send out a large number of surveys, we send it to all of our 182 member countries. And so, 136 countries that participated is 75 percent, which is a very good response rate for a global survey that we normally launch.

[Sarah Gregory] Right. Having done many surveys over the years, I know that's a tremendous response. How did you send them? Was there emails or letters?

[Jennifer Lasley] Yes, we sent the survey to all of our 182 members at that time. Specifically, we sent them by email to the WOA delegate who is typically the Chief Veterinary Officer of a country as well as to the WOA National Focal Point for Veterinary Laboratories, and we invited them to share with all of the public veterinary laboratories in their country.

[Sarah Gregory] And how did you determine which labs you wanted to participate? Did you have criteria, or did you send them to all the labs on your list?

[Jennifer Lasley] We sent them to all of the labs. It was a voluntary participation, and we had no criteria in terms of sample throughput or size of a laboratory. We really wanted to hear from everyone. And it's true that most of the equipment that was reported was coming from the central veterinary laboratory level—so, 77 percent of the equipment reported was from the central veterinary laboratory level. Because most of the equipment reported is at the central veterinary laboratory level, we suspect that the survey might be biased towards an overall better condition of the laboratory equipment. And so, in fact the real situation might be a bit worse. How much? We don't exactly know. But we do recognize that there could be bias given the voluntary nature of the survey.

[Sarah Gregory] Clarify what types of laboratory equipment specifically were you looking for, and why those?

[Jennifer Lasley] We asked about 40 different types of laboratory equipment which are critical to veterinary laboratory diagnosis, ranging from quite simple equipment to higher, complex equipment which requires certification—so, from refrigerators and freezers to biological safety cabinets to equipment needed for ELISA and conventional and real-time PCR, and everything in between.

[Sarah Gregory] What about safety of these labs? Is that part of what you were looking for? I mean, what kind of security was involved, or is that a whole other lane?

[Jennifer Lasley] It's a really important question. We did not look into infrastructure issues because it's true that often safety and security, you're going to ask questions about infrastructure around the laboratory, about the buildings themselves. And it really is a different topic, a different area, which I think is probably very complex to measure. Even though we do have other data collection methods to ask about those kinds of issues in a targeted capacity building activity that we do at WOA, it was not within the scope of this survey.

[Sarah Gregory] So what did you find from your survey?

[Jennifer Lasley] Out of the 68,455 pieces of laboratory equipment that were reported, we found that 22 percent...

[Sarah Gregory] Holy cow...

[Jennifer Lasley] ...of that equipment was not properly maintained, and 46 percent of that equipment was not properly calibrated.

[Sarah Gregory] As I said, that's frightening.

[Jennifer Lasley] Yeah. So proper calibration was systematically observed as more problematic compared to maintenance, and the important variations across regions and income levels were observed amongst our data set. And one of the main findings that we found was that there's an inverse relationship between the amount of equipment and their calibration and maintenance status. So for example, in the lowest income countries, they have the smallest amount of laboratory equipment to manage but they have the highest levels of not properly calibrated and not properly maintained equipment. And so therefore, logically we might think that it might be easier to manage a smaller amount of equipment. But actually, on the contrary, that's not what our data shows.

We also found that competencies to maintain and calibrate equipment exist in-house for 18 percent of the equipment surveyed and within one's country for 74 percent of equipment. But there are also, again, important variations across region and income levels according to the World Bank. The largest proportion of in-house expertise existed in the lowest income countries. But this actually did not translate to the higher levels of maintenance and calibration compliance, as I just mentioned. So it's quite a common intervention to build in-house expertise for laboratory equipment maintenance and calibration. But actually, we haven't seen in this survey that that large amount of in-house expertise is leading to improved calibration and maintenance of laboratory equipment. But we did find also that more respondents were satisfied with a local service provider than they were with external service providers. So that gives us some

opportunities to think about how to create opportunities for more local service provisions, such as public–private partnerships and incentives for local market development.

We also found that 11 percent of the equipment in the survey was out of service at the time of the survey; that the top three causes of malfunctioning were over usage, software problems, and electricity problems globally. But again, a different region and income group, we see marked differences. We also asked questions about the storage of obsolete, damaged, or outdated equipment. And so, what we found was that in most cases, the laboratory equipment is labeled out of service, put in storage, and isolated in the laboratory. And so therefore, there's not a disposal pathway that's present for many countries around the world and therefore there is potentially an electronic waste or e-waste problem for human, animal, and environmental health. And we know that this is a growing problem around the world with tens of millions of tons around the world of electronic waste that is contributing to devastating environmental effects. It's even worse if we think about how laboratory equipment (laboratory e-waste) may be contaminated with dangerous and infectious pathogens. So that's adding another layer to safety and security concerns to the electronic waste problem.

We also found that 49 percent of respondents reported possessing donated equipment. When we asked them to estimate how much of their equipment was donated, the average estimate was 30 percent. So the lowest income countries were most likely to possess donated equipment. At the same time, they also were experiencing the highest maintenance and calibration noncompliance. So it seems that there's also a relationship between equipment donation and problems related to maintenance and calibration compliance. I think that's all of my major results.

[Sarah Gregory] Well, that's a lot of very unhappy outcomes, I think. Was there anything that surprised you particularly? I mean, I know there were several surprises in there, but what stood out?

[Jennifer Lasley] So there were a couple of things. Having the data available in this survey helped me to understand how consumable and disposable laboratory equipment has become due to the invests and neglects like we all know all too well in public health. And so therefore, laboratory equipment, which should be a treasured resource and a precious instrument because of the high complexity and the very important tasks that it has to conduct for us in order to base our public health decisions upon in many places around the world because of a lack of local service provision or budget to repair, maintain, or calibrate equipment, we now have cost-prohibitive situations where laboratories just wait for the next opportunity that they will have to buy a new machine instead of repairing or servicing the machine that they already have. Also in our data set, there were 175 pieces of equipment used for conventional and real-time PCR that were out of service globally as of August 2019. And so, now in retrospect, thinking about the COVID-19 pandemic, those were 175 PCR machines that were not available and ready to go and to be used during the response to COVID-19 in 2020.

[Sarah Gregory] There were definitely some barriers to maintaining these labs. Is there anything else you want to tell us about the barriers?

[Jennifer Lasley] Yes. There are many barriers that were cited in the survey related to maintenance calibration of veterinary diagnostic equipment, such as very expensive services, insufficient budgets available, no local service providers to service equipment, and also a lack of in-house expertise to be able to conduct preventive maintenance. Also, difficulties related to

procurement, expensive consumables and unavailability of spare parts, and in some cases that having good laboratory equipment practices in place was simply not a priority.

[Sarah Gregory] What do you suggest should be done to build veterinary laboratory capacity over time and to overcome these barriers?

[Jennifer Lasley] Laboratory managers and directors should know the value of the equipment and the instruments that they operate and use, and they should have a far bigger role in its choice and purchase, especially if the laboratory equipment is donated. The equipment maintenance and renewal is a highly neglected budget line in laboratory budgets. To be able to calculate it, you need to know the value of the equipment in your laboratory. The challenge now is that most laboratories in low- and middle-income countries are only the end-users of the equipment in their lab. On many occasions, the value of that equipment, as well as the supply chain to get it to them, is unknown to them because the ordering is done in offices in other parts of the world on their behalf by the people who are actually paying for the laboratory equipment in the framework of a technical support project. So without knowledge of the value of the laboratory equipment, good budgeting practices that will ensure good laboratory management practices will not be able to be put in place. So we typically...in the exercises that we do at WOAHP to support countries in understanding the investment plan and developing investment plans for sustainable laboratory networks, we include an allocation of 10 percent of the value of all laboratory equipment for maintenance and calibration, and we also include the calculation of renewal rates over the lifespan of laboratory equipment so that the budget will be able to cover these expenses, and therefore ensure a more sustainable, efficient, safe, secure, and high-quality laboratory service.

[Sarah Gregory] What are the public health implications of your findings? What are the most important things?

[Jennifer Lasley] So veterinary laboratories and public health laboratories in the end are not that different from one another, as I said before. They have the same functions, the same units within the same laboratory—bacteriology, virology, microbiology, high-throughput sequencing, etcetera. All sorts of units across veterinary laboratories and public health laboratories are very similar. Also, there are many more laboratories in the public health domain working in clinical and public health settings than there are veterinary laboratories. And so therefore, if we think about this study in veterinary laboratories, we have to ask ourselves the question how big the same problem might be in public health and clinical laboratories around the world. There's no data that exists on that, so that's the first thing that we need to know. If we take this study as an indication, then it could be a big problem. So how can we trust the results we obtain if the instruments that we use in laboratories are imprecise, and to the point where only where one out of every two pieces of laboratory equipment might be giving imprecise results? This is a really big issue. We have to think about can we trust the laboratory equipment if the laboratory equipment maintenance and calibration practices are not best practices?

[Sarah Gregory] How do you personally hope these findings will be used going forward?

[Jennifer Lasley] So we have engaged with associations of animal health diagnostics manufacturers to address our common problem, which is that what I've just stated, that the results that we obtain need to be able to be trustworthy as well as accurate and rapid. And so therefore, we have a common challenge with animal health diagnostic manufacturers, because they produce diagnostic kits and reagents that rely on precise and well-maintained equipment.

And so, the sensitivity and specificity of any diagnostic kit, the promises that the industry will make about any particular kit...if the instruments required are imprecise, their product will never be able to live up to the promise that they make. And so therefore, we have a common challenge and we want to be able to work together so that we can address the issue of laboratory equipment maintenance together through common work and common goals (the dissemination of good laboratory equipment management practices), and ultimately so that we can change the behaviors of several different groups of partners and donors to ensure that we can reduce the proliferation of laboratory equipment and not the good practices to maintain and realize the good and healthy lifespan of the laboratory equipment that was manufactured to provide.

[Sarah Gregory] You touched on this early on, but what role does One Health play in all of this?

[Jennifer Lasley] Well, since One Health is the integrated and unified approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems, it's really important that the issues that are coming at the interface of people, animals, and ecosystems are addressed. And as we know with zoonotic disease, with antimicrobial resistance, with food safety, there are so many ways that the challenges encountered in one sector can have important impacts on the health of the other ecosystems. And so therefore, as we've seen with COVID-19 and many other zoonotic epidemics and pandemics, the veterinary laboratory plays a critically important role—just as clinical and public health laboratories play—in the health of people. And so therefore, working together, ensuring that the coordination, collaboration, and communication are improved across the different sectors will improve preparedness and readiness for the important One Health challenges that will certainly come.

[Sarah Gregory] On a final personal note, is there a particular disease or diseases or disease threat that concerns you the most?

[Jennifer Lasley] Over the course of my career, avian influenza has been a very...a dogged challenge that we're facing both in the veterinary health sector as well as in the public health sector. And so, given that every year that goes by, we're seeing more and more challenges related to avian influenza, especially as it's infecting wild birds and moving into more and more territories around the world, being detected in new species and being more transmissible across subspecies, I find it to be a really daunting challenge for the future, especially as it's propagating amongst birds and poultry with very large numbers across the world.

[Sarah Gregory] We've actually done several H5N1 pod...I've done several H5N1 podcasts recently, and specifically how it's showing up in mammals which, as you say, is pretty terrifying.

On that note, thank you very much for taking the time to talk with me today, Jennifer.

[Jennifer Lasley] Thank you very much. It was a pleasure.

[Sarah Gregory] And thanks for joining me out there. You can read the April 2023 article, Global Veterinary Diagnostic Laboratory Equipment Management and Sustainability and Implications for Pandemic Preparedness Priorities, online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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