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## Prioritizing PCR Amid the Pandemic: A Comparison Between Polymerase Chain Reaction & Antigen Testing for COVID-19

### Announcer:

You're listening to *COVID-19: On The Frontlines* on ReachMD. On this episode, sponsored by Cepheid, we're joined by Dr. Susan Butler-Wu, Director of Clinical Microbiology at the Los Angeles County USC Medical Center and Associate Professor of Clinical Pathology at the Keck School of Medicine of USC in Los Angeles, California, to discuss polymerase chain reaction testing, or PCR testing, versus antigen testing for COVID-19. Let's hear from her now.

### Dr. Butler-Wu:

Yeah, so some background on antigen and PCR testing for COVID-19. In essence, PCR testing or a nucleic acid amplification testing, NAA testing, generally looks for the presence of the viral nucleic acid, the RNA. In contrast, antigen testing looks for the presence of the protein from the virus. And so, that's the basis of those two assays.

Some of the pros and cons of antigen testing compared to PCR, when we think about this topic, we want to think about what the intended use of the test is. So, if I'm symptomatic, I have symptoms, which test should I use? Compared to when I'm asymptomatic and I'm trying to use a test to decide whether I may be infected with COVID, but don't have symptoms. And that is more, almost like the public health use.

So, with respect to the first, which is when I'm symptomatic, I have symptoms, what are the pros and cons of these two methods? Obviously for antigen, one of the major pros is its speed, and you can perform testing in your own home. There are multiple assays that are available in the U.S. that have emergency use authorization from the FDA. And so, in that setting, if you are symptomatic and you have a positive antigen test, and for example, you were exposed to somebody with COVID, that's wonderful because you get a quick answer, you can self-isolate. In terms of costs, they're cheaper than PCRs, although arguably, still a little bit too expensive for routine regular use for lots of folks in this country. So the main pro there would be speed and relatively low cost compared to a lab-based test.

The cons are sensitivity, so, meaning how good are they at detecting the presence of infection? So, when somebody is symptomatic, the test performs well, but it is not as good as PCR. So, we know that the sensitivity depending on the study is around 80 percent for folks who are symptomatic, some studies maybe 90. So, that means for every symptomatic, every five symptomatic patients, the antigen would be falsely negative in maybe one of those people. So, obviously, that's a con. People thinking that their symptoms are not due to COVID and then continuing to go out and about is a very significant con.

In contrast, PCR has a higher sensitivity, it's less likely to be falsely negative. But the con is obviously its cost, particularly when it's performed in a laboratory. But some of that, is, unfortunately, a function of healthcare in the United States, generally that anything in healthcare setting is over-inflated in terms of cost.

The major con really with PCR, and much has been made of this in the media, is the idea that it is somehow prone to false positives. And I just want to dig into that a little bit. False positives means you detect something when there is not actually infection present. And what we know is these tests, when they've done in labs, there really isn't an issue with false positivity. The detection of COVID-19 inpatient who's asymptomatic, it can be difficult with PCR, and this arise the confusion is that these results can be unexpected, but what it really indicates was that you had COVID, it's just that it occurred quite some time ago. The studies vary from anywhere you know extended positivity for a month up to a couple of months. So, that's one of the major cons and that's why this concept of pre-test probability, why are you doing the test, and how likely is it that you're expecting a positive result is something that's always guided us in laboratory testing, but has, kind of, gone out the window a little bit with COVID-19. So, you really have to ask yourself what the intended use is.

The next way that these tests are used is for asymptomatic testing. And this is where it gets problematic. Antigen testing, because it can be performed in the home, a lot of people might be thinking they can use this test to decide that they don't have COVID and therefore can go mix this is all hinges around the fact that antigen positivity correlates reasonably well with culture positivity. The problem is that transmission of COVID can occur by people who have low viral loads, don't have a lot of virus there, and who would be expected to be negative by an antigen test. So, we know that the secondary attack rate, meaning if I'm infected with COVID and I spread it to somebody else, it's 12 percent for people with viral loads that would be likely to be negative by the antigen test, compared to 24 percent for people with high viral loads. So, I think that people need to be really aware that a negative test does not rule out infection.

PCR testing has been hugely important in healthcare settings, particularly in the hospital setting. Number one we want to be able to know whether we need to the providers need to know whether they need to put a patient into respiratory appropriate respiratory precautions so that's a huge piece of it. The second part, though, comes down to individual patient management. So, if the PCR gives us relatively rapid answer that means that that patient, the doctors know what the cause of their infection is and they can be put on certain therapies that may be appropriate. So, you're not going to give remdesivir if you know that this is a patient being admitted with RSV, respiratory syncytial virus, for example. So, it's really important to have that answer with PCR in the healthcare setting to be able to take and manage take care of patients and manage them most appropriately because then, you know, what you're dealing with, right? Otherwise, you're flying blind.

It's also really important from a standpoint of reducing the potential exposure of staff to patients who are infected with the SARS-CoV-2 virus. So really, this has been a critical element of managing the COVID pandemic, with respect to healthcare settings. And when we didn't have the ability to do PCR in-house, in our own hospital laboratory and get rapid results back, it just created chaos. So, it's become, sort of, the standard to have it now, but it's not that long ago that we really struggled in this country to have that, and it really was nothing short of chaos.

Announcer:

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