

**Article:**

Sophonie Jean, Carey-Ann D Burnham, Kimberle Chapin, Omai B Garner, Nitika Pant Pai, George Turabelidze, Susan Butler-Wu.

*At-Home Testing for Infectious Diseases: The Laboratory Where You Live*

Clin Chem 2022; 68:1 19-26 <https://doi.org/10.1093/clinchem/hvab198>

**Guest:** Dr. Sophonie Jean is the Assistant Director of Clinical Microbiology and Immunoserology at Nationwide Children's Hospital and Assistant Professor of Pathology at the Ohio State University in Columbus, Ohio. Dr. Kimberle Chapin joins her from the Department of Pathology and Laboratory Medicine at the Albert Brown Medical School in Providence, Rhode Island, and Medical and Scientific Affairs at Cepheid in Sunnyvale, California.

Bob Barrett:

This is a podcast from *Clinical Chemistry* sponsored by the Department of Laboratory Medicine at Boston Children's Hospital. I am Bob Barrett. Interest in at-home testing for infectious diseases is growing. The need for at-home testing, specifically for COVID-19, has been hotly debated in the media. But this is not the first time nor the first infectious disease for which at-home testing has been advocated. At-home testing for HIV and other sexually transmitted infections is available and has been vigorously debated. Health equity to marginalized communities and reduction of disease transmission or among purported benefits of widespread availability of at-home testing.

A number of questions remain regarding at-home test accuracy and ability to impact patient outcomes in public health while protecting patient privacy. A Q&A feature appearing in the January 2022 issue of *Clinical Chemistry* examines this very issue. Expert clinical laboratorian, physicians and public health officials weigh in on these questions with specific emphasis on newly approved at-home test for COVID-19 during the global pandemic.

We are pleased to have two of the Q&A participants in this podcast. Dr. Sophonie Jean is the Assistant Director of Clinical Microbiology and Immunoserology at Nationwide Children's Hospital and Assistant Professor of Pathology at the Ohio State University in Columbus, Ohio. She is joined by Dr. Kimberle Chapin from the Department of Pathology and Laboratory Medicine at the Albert Brown Medical School in Providence, Rhode Island, and Medical and Scientific Affairs at Cepheid in Sunnyvale, California.

We will start with you, Dr. Chapin. At-home testing: the name itself defines where the testing can be performed, but, as a laboratorian, can you better

define what an at-home test is and how they differ from traditional laboratory-based tests?

Kimberle Chapin:

Sure. That's a great question because there's actually a lot of confusion, even by providers, for what an at-home test is. And so, right off the top, let's clarify. There's two significant parts of an at-home testing process. One is just the at-home collection and then the second is the performing of the test itself. And in this article that we wrote for AACC, we actually divided up those two components to clarify.

So, for at-home collection, there's currently many tests that exist for you to collect just the specimen in the privacy of your home and then forward that to a certified laboratory, which is a more traditional laboratory; they get inspected, they have quality parameters, they have trained personnel. The multiple reference labs, as well as academic medical centers, even large companies such as Amazon, created their own home collection kits for patients and employees, especially for COVID, because it eliminated that huge bottleneck in the COVID testing process early on, which was that we couldn't get specimens from everybody we needed to. As well as the at-home collection provide a safer arena for people to be able to collect their own specimen; they didn't have to come to a site and then infect other people as well. So, that was a great component of at-home collection.

So, the other piece is actually the performance of the assay at home and that's a different animal of itself and there's really two types of at-home test that currently exist that have emergency use authorization. Those include antigen tests and molecular tests. Now, none of these have full FDA clearance. They're only under that EUA, the Emergency Use Authorization, due to the public health emergency.

The only FDA cleared ID test in the U.S. right now is the OraSure test for HIV 1/2 antibodies, and this took over 10 years. So, that just gives you a sort of timeline and the complexity that we'll go into a little bit. So, as far as those two types of tests, the antigen test, when we first wrote this article of a year ago, there were only about 16 antigen tests. There's now over 40, just 4 in the last month that got approval. And these test formats become very accepted for general public use, for schools and businesses. And then there are also three amplification tests (or molecular tests) that are available. And at the time

we did this, there were only two. So, the number of tests in total now are over 43 tests that can be done at home. So, what's important to remember about all of these initial home tests is that originally, they were only available in a traditional laboratory done by trained personnel with all those regulatory requirements for quality control, interpretation, and performance requirements. And these exact same tests then morphed into those same tests that were approved for doing at home.

The other key thing was that initially, all of these tests initially approved for home use were only to be done in patients who are symptomatic and then they morphed into you can test for people who are really just doing screening. So, a lot of variables changed right from the onset of the pandemic from what we were doing in a qualified laboratory that had all these safety parameters, did the reporting, had trained personnel, to moving into that home environment.

Bob Barrett:

So, patients can test or at least collect samples themselves in the privacy of their homes without seeing a provider and get faster results using at-home test and this is all good, right? So, Dr. Jean, where's the controversy?

Sophonie Jean:

Thanks, Bob. I think this is a really important question and it gets to exactly what Dr. Chapin was talking about, right? Now, we can all pretty much agree that these at-home tests, whether they are self-collected or true tests that are being performed at home, have the potential to be incredibly beneficial particularly in this current pandemic. But where the controversy still lies is how well these tests perform in the real world, and whether or not that performance, coupled with the understanding of the test by the public, can adequately influence behavior to help stop the virus.

So, as Dr. Chapin mentioned that these tests morphed from being performed in a controlled laboratory environment to being performed at home. Well, the person at home, how well are they going to follow the instructions? How well are they going to ensure that that kit is maintained at the proper temperature in order to make sure that the performance of the test is accurate?

You know, when our manuscript is being prepared, some of our experts, including Dr. Susan Butler-Wu, who is the Director of Clinical Microbiology at the University of Southern California Medical Center, and

Dr. Chapin mentioned that there is very limited data that compared these at home tests collected and performed by otherwise untrained personnel compared to traditional laboratory-based collections. And I think even now, there is still not perfect data for this comparison. But overall, we have more studies that suggest adequate performance of these at-home tests across a variety of setting. But do these performance claims still hold true in the face of new variants like Omicron, for example?

We saw that the FDA put out a statement just at the end of December that indicated that even though some of these at-home tests or antigen tests are able to detect Omicron, they might do so at a lower sensitivity. And of course, that data is still being compiled and still being reviewed today so that we can have a really good answer on that. But that's an important question that still needs to be addressed. And of course, whether or not the public understands the limitations of these tests adequately enough to be able to make appropriate decisions about when to be retested or when to modify their protective behaviors or to seek care from a licensed provider is still an important variable that we need to continue stressing.

So, you know, a negative test is not necessarily mean carte blanche to kind of walk around and be in close intimate settings with other people, right? You still need to modify it and mitigate your potential exposures accordingly. And so, I think that's where the controversy still lies and those are questions that really, we're going to have to continue to keep addressing as long as this pandemic is with us.

Bob Barrett:

So, what role can at-home testing play for public health, both during the current pandemic and afterwards?

Sophonie Jean:

Yeah. So, we're fortunate that we had a couple of experts really in that public health field. So, Dr. Pant Pai who's an Associate Professor of Clinical Epidemiology at McGill University in Quebec and Dr. Turabelidze who's an Epidemiologist at the Missouri State Department of Health and Senior Services both weighed in on this question in our feature, and they agreed that at-home testing for COVID-19 can help mitigate community transmission of the virus by rapidly identifying and isolating positive individuals. But they also agree that at-home testing can lessen the healthcare burden since people with mild or asymptomatic exposure don't need to come into a healthcare facility to seek that testing, which, as Dr.

Chapin mentioned, was a huge bottleneck at the very beginning of this pandemic.

So, instead, people who maybe have mild symptoms or who are asymptomatic and maybe just have an exposure, they can self-test and if positive, monitor their symptoms at home. So that our limited resources, which despite being in, you know, year three of this pandemic, we still have resource limitations, those can be focused on the sickest and highest risk patients. And I think this is really important in parts of the U.S. as well as around the world where the healthcare infrastructure is limited and/or fragile.

Of course, all of that depends on widespread access, to not just one, but in some cases, multiple home tests for serial testing -- as some of the manufacturers of these tests indicate is necessary. And I think the fact that some of these home tests are starting at costs of greater than \$25.00 retail is not negligible, right? That means that it may not be accessible to all parts of the public, and I think we need to acknowledge that. Additionally, we need to make sure that there is sufficient patient education so that people know what to do next based off of their test results.

You know, outside of the COVID-19 pandemic, home testing or even just home collection for some infections, like sexually transmitted infections, can potentially plug in patients with limited access to care facilities to much-needed screening and testing and appropriate care to help prevent negative outcomes. And I think now that we're sort of becoming more and more comfortable with at-home testing, we are going to see some changes in that space regarding potentially broader use of home collection for STIs.

And finally, reporting test results to public health and health departments is still a challenge. With traditional lab tests, many of those communicable infections are directly reported by the laboratory performing that test to the local health department. But home tests that are not proctored or don't interface with an app that automatically reports to public health authorities, they require that the test taker self-report to either a healthcare provider or to their local public health officials. So, that's another variable that we just don't know about. How many people are actually taking that time to reach out to their care provider or to their local public health department to let them know of their test results,

right? And so, this can lead to under reporting and potentially pose challenges to our abilities to control these diseases.

Bob Barrett: Do you think there need to be some sort of infrastructure set up to do that?

Sophonie Jean: It would be helpful and beneficial. You know, I think especially in terms of tracking where there might be outbreaks, I think if we ever get to a space where there is not widespread transmission, community transmission of SARS-CoV-2 then there might be, you know, little pockets of outbreaks. And if people are using home tests to identify if they're sick, for example, we really need to be on top of who tests positive, when, who they were in contact with, in order to effectively do the contact tracing and the mitigation that's required to help stop the spread. So, I think that there is probably a role for that and it would be helpful to introduce that.

Kimberle Chapin: And I think one of the main things for public health or in testing in general, is the fact that the HIV 1/2 to antibody test has all of these other parameters that Dr. Jean related to which was that the results go to a provider on the site. They automatically get reported. There's automatically a thing for them to get into follow-up care for HIV and get a confirmatory test. So, I think it's all those parameters that are not consistent with all the at-home test. So, some of the things that are more recently gotten EUA is that those have gotten an app or an app on how to perform the test or an app such that you have to connect to public health so they can do that tracing. So, I think all of those parameters that we would like to see are getting added as we move forward. And if these are going to continue to be at home collection, or waive testing, they're going to have to have those kinds of components consistently. And that's where the lab folks can help. We can sort of insist, here's the quality parameters we really need to see if we want to make this work.

Bob Barrett: Okay. Well, are there any limitations about COVID-19 home test that users need to be aware of?

Kimberle Chapin: Yeah. So, there is a few critical factors that users really need to be aware of for these various tests. The comparison of the two separate kinds of tests: antigen versus molecular, is that the antigen test, as Dr. Jean already alluded to, are not as sensitive as the amplification test. The antigen tests really work best when someone's symptomatic. But they're often

being used prior to when symptoms occur or when the person is exposed. Let's say you go to your New Year's Eve party and you come home, you feel fine, then two days later, you get symptoms. But if you tested the night you came home from your party, you may not have been positive. So, that's why they give you a couple of tests in a box. So, they're more readily available to the public, they are less costly but to Dr. Jeans point they're still 25 bucks for a couple of these tests. Unless there are some situations where they're free of charge, say in the school systems; that sometimes is happening.

And just looking at the Omicron variant as she had already mentioned, the Food and Drug Administration did put out a statement saying that they are definitely less sensitive for the Omicron variant and you could get a false negative result. And part of that is just for what they're targeting different than the molecular tests. And the molecular tests, which are only three that are available at home, they actually use a variety of targets so that makes them much more sensitive. They are definitely more costly and they're not as readily available. And so, in their package inserts, though, when you read them, they don't quite equal what our PCR tests are in the laboratory. So, they're not quite as sensitive, around 90% compared to what we do in the laboratory and sometimes they have a very high rate of canceled results. So, one test in particular has an almost a failure rate of almost 9% which would not be acceptable for any of us in the lab to repeat 9% percent of all the tests that we run.

So, as Dr. Jean alluded to earlier as well, the significant piece is the performance. We really don't know what is that person doing at home, have they followed the directions, what is the reason that they're performing the test? If they're symptomatic, we're more likely to get a better result, no matter which test system we use. But if they're asymptomatic and traveling that may not give us as good a result. So, really understanding why we're doing those cases in the first place. And just as a note, most travel will involve, outside of the U.S., as having to get a PCR test. So, it is recognized that that's definitely more sensitive.

Bob Barrett:

We heard earlier how long it took that HIV home test to get approved, do all the current COVID-19 home tests have U.S. FDA emergency use authorization? And going forward, will all such tests require FDA clearance for home use?

Kimberle Chapin: Well, right now, they are all just EUA. There's only one COVID test, right? Well, a couple of COVID tests that are lab high complexity tests that have FDA clearance. But basically, they're all EUA. And that does mean that if they want to move forward, are they all going to move forward for regular FDA clearance? Right now, because we're still in the public health emergency, the FDA is still giving that passage for a lot of test components still. Like I said, just four in the last month. So, they're really still moving those along in order to be able to get antigen tests into as many people's hands as possible.

Bob Barrett: Well, finally, and I'll ask this is to both of you, looking ahead, what role do you think at-home testing for COVID-19 and other infectious diseases will play in the future?

Kimberle Chapin: I think at-home collection is here to stay. I joked about it being the Pandora's Box that was opened. Home collection is definitely here is already here and has been here especially for STIs and some other things. But at-home testing, actually running the assay at home, I don't think it's too far behind in certain settings or for near patient or alternate care settings. Because in the last two years, we've had over 40,000 CLIA waived sites that popped up during COVID. Which basically meant that you had to have minimal clinical experience and training to run the test. So, I think that's really significant. And COVID has really shown us in the lab and the diagnostic world that people are quite comfortable with at-home collection. They like the convenience and the privacy. But like we've said, there has to be a consistent way to rope in all those other safety components, especially if we move to something like blood collection and testing. Which the public health labs right now are really pushing to try and get HIV, HCV testing in the same kinds of settings and interpretation and capturing of the data transmitted securely information and all those benefits of home testing are going to have to be realized.

So, for instance, if you're in a large healthcare setting which both of us have been or are, and you have a lot of integrated healthcare networks which are far away from that major lab, home collection really can afford an opportunity to integrate more consistency in the quality of the test that you might be able to provide for your whole network. Without having to bring the patient into that building, you know, far away. And with the right education and oversight, especially in

companion with Telehealth, that could be a real win-win situation in a lot of settings. So, I think that this will be rolled out in future pandemic preparedness and now, for other critical public health needs such as STIs. So, yeah. I think it's here to stay in some capacity or all.

Sophonie Jean:

Yeah. And I would have to agree with Dr. Chapin on this. I really do think that it's open and it is now sort of a new area, a new space; not necessarily new but a space that I think we're going to see a lot more movement and potentially much more rapidly than we have in the past like for example, with the HIV or short quick test, quick home test.

Another one of our experts, Dr. Mike Gardner who's at UCLA Health System, and a lot of our other experts actually, all noted that we still will need to maintain that vigilance on the performance of home tests. Especially with the new variants and the ability of these tests to really influence the pandemic response through large scales that is right. We need to, for sure, prove that utilizing these home tests makes us better able to control this pandemic. In that way, we're prepared for the next viral pandemic that occurs and we will have enough confidence and enough experience to be able to rapidly deploy these types of home tests at the beginning stages so that we can sort of get it under control before it sort of spirals on us. And that's also going to be important to just help bolster the confidence of the public and really help them understand how to utilize these tests and what to do next once they have those test results.

I think we're moving in the right direction with how to utilize COVID-19 home testing. Dr. Chapin mentioned that some of the newer tests that are being approved are already starting to integrate these pieces that maybe were not fully realized an early approvals, like the public health reporting, like connecting whoever is tested at home to care, and I think if we're able to do those kinds of things, then we will certainly see that home testing and especially home collection for STIs expand throughout the U.S. We already saw just in March of 2021 the first STI point-of-care test that was approved and I think with there being, you know, limited access to care settings and people still needing STI screening, a lot of laboratories are looking to expand their ability to do home collection as Dr. Chapin mentioned. So, I think this is just the beginning and I think that, you know, this sort of test case is trial by error that we're learning through COVID is really going to serve as the example for how

we can expand this in other realms of infectious disease testing.

Bob Barrett:

That was Dr. Sophonie Jean from the Nationwide Children's Hospital and Ohio State University. She was joined by Dr. Kimberle Chapin from the Department of Pathology and Laboratory Medicine at the Albert Brown Medical School in Providence, Rhode Island. They both participated in a Q&A feature in the January 2022 issue of *Clinical Chemistry* on at-home testing for infectious diseases and were our guests in this podcast on that topic. I am Bob Barrett. Thanks for listening!