REPORT TO THE BOARDS OF HEALTH

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Mid-Michigan District Health Department, Wednesday, June 24, 2020
Central Michigan District Health Department, Wednesday, June 24, 2020
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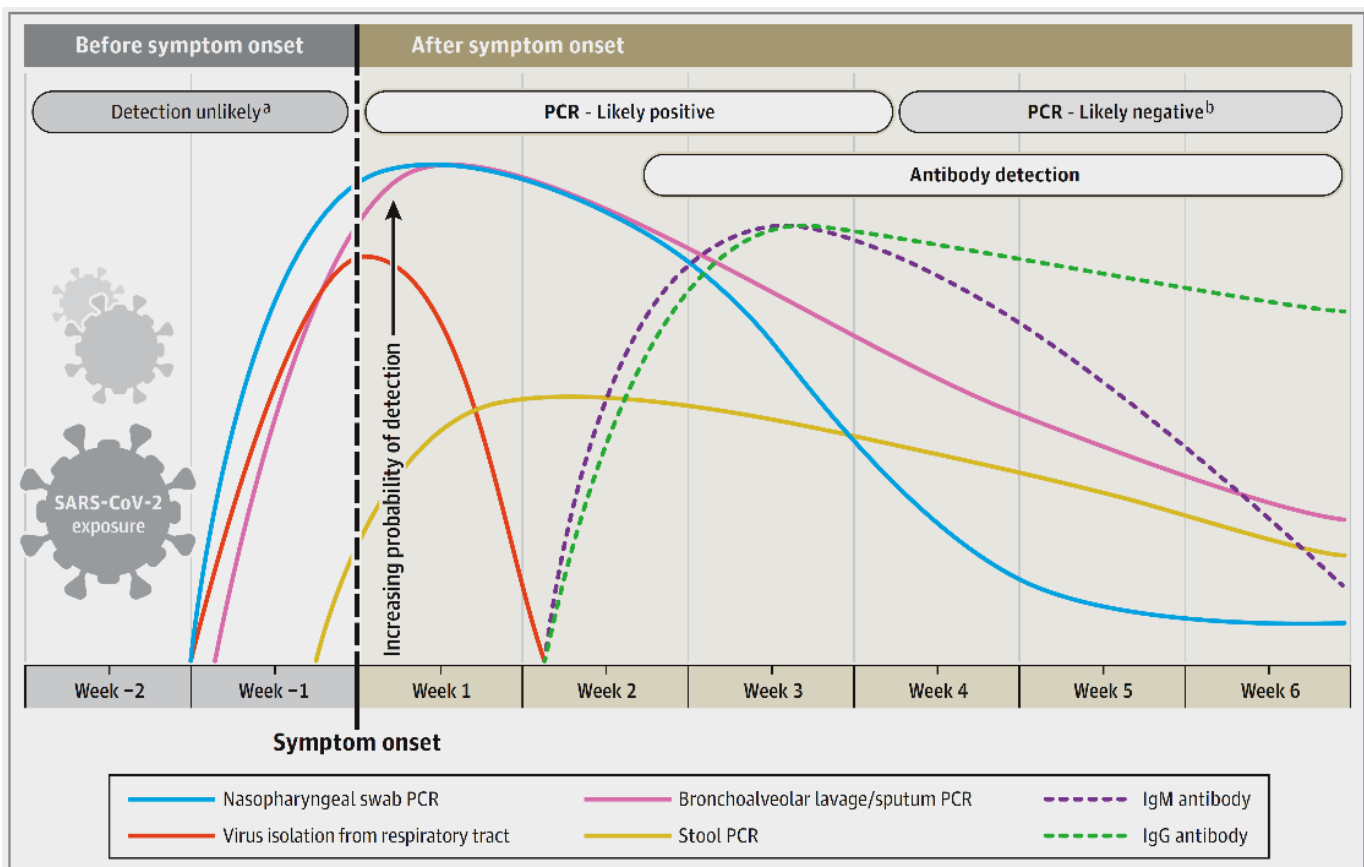
Testing for COVID-19

There are two main types of tests available for COVID-19. One type is considered diagnostic, and tests for the actual virus to find out if you are infected. This type of test looks for either genetic material (PCR test) or proteins from the virus (antigen test). Another type tests to see if you have developed antibodies to COVID-19, which is a sign of a past infection. Easy access to tests that diagnose COVID-19 is very important for patient care, protection of healthcare providers, and for controlling the pandemic. It has been very hard to secure the tests that are needed. Ability to test depends on availability of testing materials, supplies, instrument capacity, technician capacity, and PPE availability.

On May 24, U.S. Department of Health and Human Services submitted a report to Congress regarding a strategic testing plan for COVID-19. It charges the states, territories, and tribes with the responsibility of determining and implementing testing plans, with the role of the federal government listed as enabling innovation, helping to scale supplies, and providing strategic guidance. Citing recommendations of the World Health Organization and other major public health organizations, the report mentioned a testing goal of keeping the proportion of positive test results (or percent positive) at 10% or less. If a higher percentage of tests are positive, it is likely you are not testing a wide enough group of the population and may be missing infected people. As of June 15, the percent positive for Michigan is 2.43%.

Initial testing plans from states for May and June were due to HHS on May 30 and were due June 15 for the remainder of 2020. HHS has provided states with technical assistance and feedback regarding their plans. State goals ranged from 2.0% to 14.9% of the population tested each month. The goal for Michigan was set at 4.5% of the population per month. Knowing that increasing testing this amount is difficult, the federal government recommends states initially aim for testing 2.0% of the population in May and June. As of April 21, 1.2% of Michiganders had been tested since the beginning of the pandemic. The testing numbers for Michigan have increased dramatically and from May 15 to June 15, 460,705 PCR tests were done, accounting for 4.6% of the population.

These plans to test large numbers of people must keep in consideration that testing capacity is still limited and testing should be devoted to those that will most impact the reduction and prevention of COVID-19 illness and death. Those to be tested should be guided by local COVID-19 disease activity as well as testing resources. Some of the important people to test include:

- Anyone with symptoms and suspected of having COVID-19, even if the suspicion of COVID-19 is low.
  - This is important to identify cases of COVID-19 because diagnosing COVID-19 on just clinical evaluation has been found to be difficult and inaccurate.
  - It is important to identify cases so that they can be properly investigated, and contacts can be put into quarantine.

- Close contacts to COVID-19 cases.

- People in high risk congregate settings, such as nursing homes, assisted living facilities, jails, prisons, homeless shelters, if there has been a case of COVID-19 in the facility or if there are high levels of COVID-19 in the community.

- Workers in high density, critical infrastructure settings with known exposures to cases of COVID-19, especially those with other risks for exposures, such as migrant workers or others living in crowded housing.

We also need to strive to have accurate testing. Currently, there are no COVID-19 tests fully approved by the FDA. The tests being used have been issued an Emergency Use Authorization (EUA) which only required the test developers to establish "acceptable" accuracy. These types of authorizations are allowed during an emergency when there are no other approved or available options and does not require the evidence needed for a full approval. Initially, some antibody tests were being sold without even an EUA, however the FDA did stop this and has ordered all tests without an EUA off the market.

The accuracy of a test is measured by its sensitivity and specificity. The sensitivity and specificity help define how well a test can provide accurate negative or positive results. **Sensitivity** is a measure of how often the test is positive when the person being tested actually has the disease, which is also called a **true positive** result. As an example, if a test for COVID-19 has a sensitivity of 70%, then 70% of people that are truly sick with COVID-19 will test positive. The other 30% would test negative, referred to as **false negative**.

Specificity is a measure of how often the test is negative when the person being tested does not have the disease, also called a **true negative**. As an example, if a test for COVID-19 has a specificity of 90%, then 90% of people that were not actually sick with COVID-19 would test negative, also called a **true negative**. The other 10% would test positive, referred to as **false positive**.

When most of the current COVID-19 PCR tests evaluated their sensitivity and specificity, they used samples of pure SARS-CoV-2 virus. In these perfect conditions, most of the tests did very well. In reality, many other things factor

in to how a test does, such as how much virus a person is shedding when the test is done, how well the sample is taken, how the test is packaged and shipped, and so on. While it is more difficult to determine the sensitivity and specificity of a test as it is being used in the real world, many have been evaluating COVID-19 PCR tests. A large review of thousands of tests done in New York estimated that the sensitivity of PCR testing ranges from 57.9% to 94.6% and specificity ranges from 99% to 100%. That means that **a negative PCR test is a false negative 5.4% to 42.1% of the time**. This is very important to know, as it means **a negative test does not guarantee that you are not infected with COVID-19**. However, a positive test result has only a 1% chance of being a false positive. This means if it is positive, you have evidence of COVID-19 in your system. This does not always mean you have living, contagious virus in your system, and people have been found to be positive by PCR for many, many weeks after they have recovered from illness.

Antibody tests, also called serology tests, are not helpful in controlling the spread of COVID-19 because antibodies against COVID-19 don't form until after a person is no longer contagious. A recent review of antibody tests found that the sensitivity of these tests ranged from 46.37% to 93.11% and the specificity ranged from 96.93% to 99.48%. We don't yet know if having antibodies means you are immune to COVID-19 and if you are, how long it might last. Antibody tests can be helpful in some situations. If a patient has no symptoms of COVID-19, the PCR test is positive and the diagnosis is in question, testing for and finding antibodies might help confirm if they were infected. If someone is later in their illness and the PCR is negative, positive antibodies can help add to the evidence they did have COVID-19. Antibody testing is used to help identify those recovered from COVID-19 illness that are suitable for donating plasma which is used experimentally to treat those with severe COVID-19. Antibody testing is also used as part of vaccine trial studies and to help study the general population to see the prevalence of COVID-19 illness.

The sensitivity and specificity of the test, along with the amount of people in the community that are sick with COVID-19, or the prevalence of illness, can help to calculate how likely a test result is to be accurate. The **positive predictive value (PPV)** is the probability that a person with a positive test result truly has the illness that is being tested for. When there is lower prevalence of illness in the community, then the positive predictive value will be lower, i.e., it is less likely a positive test result is a true positive. Our counties currently have a low prevalence of COVID-19, ranging from 1% to 4%. Based on the most recent reviews of the sensitivity and specificity of PCR and antibody testing, the positive predictive value (PPV) of these tests for different levels of COVID-19 in the community are shown in the tables below.

Positive Predictive Value (PPV) of PCR testing (worst/best case scenario)		
Prevalence of COVID-19 in Community	PPV with Sens 57.9% Spec 99% (lowest)	PPV with Sens 94.6% Spec 100% (highest)
2%	54%	100%
5%	75%	100%
10%	86.5%	100%

Positive Predictive Value (PPV) of Antibody testing (worst/best case scenario)		
Prevalence of COVID-19 in Community	PPV with Sens 46.37% Spec 96.93% (lowest)	PPV with Sens 93.11% Spec 99.48% (highest)
2%	23.3%	78.5%
5%	44.3%	90.4%
20%	79.1%	97.8%
60%	95.8%	99.6%

Recommendations

1. The approach for testing for COVID-19 illness should not be focused solely on getting numbers of testing up but should be strategic to ensure that the right people are getting the right test so that the right action can be taken.

2. We need to have unified guidelines and messaging about testing for COVID-19.

3. Supply chain issues must be identified, and specific plans must be made to address them.

References

- Ulrich, A., Batkus, J., Moore, K., Hansen, G., Mathieson, M., Osterholm, M., (2020). Center for Infectious Disease Research and Policy (CIDRAP). COVID-19: The CIDRAP Viewpoint. Part 3: Smart Testing for COVID-19 Virus and Antibodies. https://www.cidrap.umn.edu/sites/default/files/public/downloads/cidrap-covid19-viewpoint-part3.pdf

- U.S Department of Health and Human Services. (2020). Report to Congress. COVID-19 Strategic Testing Plan. https://www.democrats.senate.gov/imo/media/doc/COVID%20National%20Diagnostics%20Strategy%2005%2024%202020%20v%20FINAL.pdf

- Michigan Department of Health and Human Services (MDHHS). Coronavirus. Michigan Data. https://www.michigan.gov/coronavirus/0,9753,7-406-98163_98173---,00.html

- Green, D. A., Zucker, J., Westblade, L. F., Whittier, S., Rennert, H., Velu, P., ... & Boehme, A. K. (2020). Clinical Performance of SARS-CoV-2 Molecular Testing. Journal of Clinical Microbiology.

- Hanson, K., et al., (2020). Infectious Diseases Society of America Guidelines on the Diagnosis of COVID-19

- Sethuraman, N., Jeremiah, S. S., & Ryo, A. (2020). Interpreting diagnostic tests for SARS-CoV-2. Jama.

- Vengesai A, Midzi H, Kasambala M, et al. A Systematic and Meta-Analysis Review on the Diagnostic Accuracy of Antibodies in the Serological Diagnosis of COVID-19.. Research Square; 2020. DOI: 10.21203/rs.3.rs-34638/v1.