LITERATURE REVIEW SARS-CoV 2 Diagnostics

By: Sarah El-Agha, Hannah Cook, Rebecca Wang, Anna Tomotaki; Peer Review by: Dr. Barbara Taylor updated 03/17/2021

UT Health San Antonio Long School of Medicine

WHO TO TEST (CDC Recommendation)

- People with symptoms: prioritize hospitalized, living in congregate settings, healthcare workers; first responders, long term care facility (LTCF) residents, but anyone with symptoms of COVID-19 should be tested. Clinicians are encouraged to consider workup for other pathogens, as co-infections are still possible. If a positive test is found in a LTCF, serial weekly testing should be considered for outbreak control
- People who are asymptomatic: individuals who are prioritized by health departments or clinicians, including but not limited to: close contacts of people with COViD-19, public health monitoring, sentinel surveillance, presence of underlying medical condition or disability, residency in a congregate housing setting such as a homeless shelter or long term care facility, or screening of other asymptomatic individuals according to state and local plan

NUCLEIC ACID AMPLIFICATION e.g., PCR (test for active infection, detects viral RNA)

- Positive PCR may not reflect transmissible infection as reliably as a positive viral culture, PCR can detect non-infectious viral fragments.
- PCR sensitivity ranges from 42%-98.8% with a meta-analysis pooled sensitivity of 89%; there are patients who have positive PCR tests after already testing negative, demonstrating increased sensitivity with repeated testing
- Variables in PCR detection sensitivity include disease state, sample type and technique, and test manufacturer
- CDC recommends nasopharyngeal, oropharyngeal, nasal mid-turbinate or anterior nares swab specimen, nasopharyngeal/nasal wash/aspirate, or supervised self-collected saliva specimen; a nasal mid-turbinate specimen collected using an at home kit is also acceptable; a specimen study suggests lower respiratory samples have higher detection rates than upper respiratory samples*
- PCR testing has the lowest false negative rate on day 8 post-SARS-CoV 2 infection
- If found positive, CDC recommends against repeat testing for at least 3 months
- Pooled testing, which has been utilized by other countries, has the potential to save time, money, and increase efficiency compared to individual testing, but may have diminished returns if prevalence is above 10%
- Several combination tests that test for SARS-CoV 2, influenza A, and influenza B simultaneously have received FDA EUA such as the CDC flu SC2 Multiplex Assay and Xpert Xpress SARS-CoV-2/Flu/RSV tests

ANTIGEN TESTING (test for active infection, detects viral proteins)

- Results are ready in minutes, but antigen tests have lower sensitivity (~80%), also seen in influenza rapid tests
- WHO recommends that if access to RT-PCR assay is limited or turnaround times are too long for clinical utility, then antigen tests with minimum sensitivity of 80% and specificity of 97% can be used if test is conducted within first 5-7 days of symptom onset
- Recent concerns about the BD and Quidel rapid antigen test's high false positive rate has led to some questions regarding its utility, particularly in asymptomatic individuals
- Antigen tests' efficacy for community surveillance have shown mixed results as the Abbot BinaxNOW test has shown variable sensitivity of 81.4% and 35.8%, and 53.3% in asymptomatic individuals in three separate studies, while the Soria test showed sensitivity of 41.2%*
- A population health survey of 65% of the population of Slovenia using antigen testing (Biosesnory Standard, RapiGEN, and Abbott) demonstrated that mass antigen testing may have a role in high prevalence areas, but is of limited utility in low risk regions

SEROLOGY (test for past infection, detects antibodies)

- The CDC has recommended that serologic testing should not be used to establish absence or presence of SARS-CoV 2 infection
- Infectious Diseases Society of America lists 3 indications for serology:1) evaluation of patients with a high clinical suspicion when RT-PCR is negative and two weeks have passed since symptom onset; 2) assessment of multisystem inflammatory syndrome in children; 3) serosurvellance
- Positive serology may not confer protective immunity-there are conflicting studies on neutralizing ability of the S1 protein antibodies
- The 2003 SARS infection does not fully protect from SARS-CoV 2 and false positives due to the 2003 SARS infection are unlikely as it has not circulated the human population since 2003; positive neutralization of SARS-CoV 1 was found to be undetectable six years after infection
- IgG and IgM antibodies are observed as early as the 4th day after symptom onset. IgG has been shown to be more sensitive, but IgM was more specific and had a greater positive predictive value.
- Symptomatic patients are more likely to test positive for IgM; In acute infection, IgG levels are significantly higher in symptomatics
- Antiviral antibodies against SARS-CoV 2 have been shown to remain elevated approximately 5 months after diagnosis in patients iwth mild to moderate symptoms and up to 7 months in patient swho had severe disease

STATUS OF TEXAS

- As of March 5th, 2021, San Antonio/Bexar County is conducting over 50,000 tests per week and the percent positivity rate is 2.6%
- Many Texas health insurers and health maintenance organizations are waiving copayments, deductibles and coinsurance for COVID-19 testing; a list of participating insurance companies are listed here: https://www.opic.texas.gov/coronavirus ·
- There are currently over 90 testing sites in Bexar county with 21 of them being drive-thru testing or walk up (PCR)–they can be found here: https://covid19.sanantonio.gov/What-YOU-Can-Do/Testing#TestingLocation

For details and references please visit **https://oume.uthscsa.edu/longco/**