LITERATURE REVIEW SARS-CoV 2 Diagnostics

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WHO TO TEST (CDC Recommendation)

- Symptomatics: hospitalized, live in congregate settings, healthcare workers, first responders, long term care facility (LTCF) residents, or anyone with symptoms of potential SARS-CoV 2 infection. Clinicians are encouraged to consider workup for other pathogens, as co-infections are still possible. If positive test is found in a LTCF, serial weekly testing should be considered for outbreak control
- Asymptomatics: individuals who are prioritized by health departments or clinicians, including but not limited to: 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)

- Positive PCR may not reflect transmissible infection as reliably as 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 reverted to 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
- As of May 22nd, CDC recommends nasopharyngeal, oropharyngeal, nasal mid-turbinate or anterior nares swab specimen, or nasopharyngeal/nasal wash/aspirate; a specimen study suggests lower respiratory samples have higher detection rates than upper respiratory samples, and PCR via saliva samples have shown to detect SARS-CoV 2 in 87-92% of positive patients
- PCR detection of SARS-CoV 2 in stool samples remains positive after oral swab samples indicated convalescence, but researchers are unable to culture from stool samples, suggesting that this may not be a route of transmission
- PCR testing has the lowest false negative rate on day 8 post-SARS-Cov 2 infection
- Chest CT is a good test to consider alongside PCR due to CT's higher sensitivity (97.2%) in comparison to PCR

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

- Results are ready in minutes but antigen tests have notoriously suboptimal sensitivity, a similar problem comparable to influenza
- Texas Med Clinic is offering the Quidel Antigen test which has a self reported positive percent agreement of 80%
- Antigens are generally only detected when virus is actively replicating, therefore test is recommended only during acute infection

SEROLOGY (test for past infection, detects antibodies)

- As of July 21st, the CDC has recommended that serologic testing should not be used to establish absence or presence of SARS-Cov-2 infection or reinfection
- Positive serology may not confer protective immunity—there are conflicting studies on neutralizing ability of the S1 protein antibodies, however IgG antibodies to S1 are considered the best target for antibody testing in the most current literature
- 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 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
- SARS-Cov-2 E antigen is involved in viral assembly and pathogenesis. It was demonstrated that recombinant coronaviruses lacking the E protein displayed significantly reduced viral titers and impaired viral maturation suggesting its importance during infection
- Though IgA antibodies are detected earlier, they have no clinical utility due to their low specificity

STATUS OF TEXAS & US TESTING?

- As of July 21st, 2020, Metro Health's testing capacity is 7, 417 per day, which does not exceed the estimated need of 8.200 tests per day based on our population; this does not include unreported tests
- There have been 237,768 COVID-19 test results to date, with 86.5% returning negative, 13.3% returning positive, and 0.2% inconclusive
- 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 40 testing sites in Bexar county with four of them being drive-thru testing (PCR) by appointment –they can be found here: *https://covid19.sanantonio.gov/What-YOU-Can-Do/Symptoms-Testing/Map-of-COVID-19-Testing-Sites-in-Bexar-County*

KEY POPULATIONS

- Men express ACE-2 (the receptor for SARS-CoV-2 entry) more than women and may have a predilection for critical disease; Asians express more ACE-2 receptors on their lung parenchyma, relative to white and black populations but this should not guide allocation of testing resources. Men express more TMPRSS2 (interact with S protein of SARS- CoV-2) than women which may also explain critical outcome differences
- Populations experiencing homelessness are a significant source of transmission and cases, so rapid testing modalities with access to follow-up serial testing in this population may represent efficient utilization of resources
- For low socio-economic status populations, healthcare cost perception may represent a barrier to engagement in testing. These patients are more likely to present later In disease course with higher ferritin and creatinine phosphokinase levels
- Children have been reported to transmit SARS-CoV-2 past a 14 day isolation period

Discrepancies in US Race and Ethnic Representation in the US Population vs COVID-19 cases

	US Population	COVID-19 Cases
Caucasian	60.4%	43.4%
Non-hispanic Black	13.4%	32.0%
Hispanic or Latino	18.3%	11.7%

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