Diagnosis: COVID

UNDERSTANDING COVID-19 DIAGNOSTIC TESTS AND HOW TO USE THEM

DR. KEVIN J. STINSON, PHD CIC
PROGRAM MANAGER, IPAC
ST. MARY’S GENERAL HOSPITAL, KITCHENER ON
What is PCR?

**PCR Components**
- DNA Sample
- Primers
- Nucleotides
- Taq Polymerase
- Mix Buffer
- PCR Tube

**PCR Process (One Cycle)**
1. **Denaturing**
   - 95°C - Strands Separate
2. **Annealing**
   - 55°C - Primers Bind Template
3. **Extension**
   - 72°C - Synthesise New Strand

*Images sourced from boosterbio.com*
Understanding qPCR
COVID-19 Shedding

- 24-48 hours pre-symptomatic positive Ct ~30
- Peak viral load/onset Ct ~10
- 5-7 days post onset Ct ~20
- 10-20 days post onset Ct ~30
- 1-3+ months post onset Ct >30, +/- gene dropoff

DOI: 10.1056/NEJMp2025631
Case Scenarios

SCENARIO 1


COVID-19 testing negative for E gene, positive for RdRp and N genes, Ct values 35 and 37 respectively.

Repeat COVID-19 testing 24 hours later shows three genes positive, all with Ct values above 30. Fever resolved.

SCENARIO 2

58 Y/O male with history of autoimmune disorder managed with 30mg prednisone daily develops COVID-19 on 11 October. Has mild course of disease and managed on room air; symptoms resolve after ~7 days.

Reswabbed on day 22 post onset of illness, remains asymptomatic; COVID testing positive for S, RdRp, and N genes, Ct values 14, 16, 16.

Reswab 24 hours later showed Ct values all high 20s.
Loop-mediated Isothermal Amplification (LAMP)

**PROS**
- Significantly faster reaction versus qPCR
- Lower equipment costs
- Currently unregulated (In Ontario, can be used a POC device without MLT oversight or POC lab license)

**CONS**
- Currently unregulated
- Loss of dynamic range/sensitivity
- Minor-groove binder for detection -> theoretical loss of specificity

**SMGH trial results**
- 93% PA (sensitivity); 99% NA (specificity)
- 100% PA for Ct <30; 67% PA for Ct > 30

DOI: doi.org/10.1371/journal.pntd.0007698.g002
Rapid Antigen Test (Lateral-Flow ELISA)

**PROS**
- Fast detection
- Easy for point of use applications
- Dynamic range narrowed to active infection (…in theory)

**CONS**
- Poorly sensitive, especially in asymptomatic or early infection (Omicron)
- Can yield false positives if not used properly
- Evidence for benefit involves widespread and frequent surveillance -> high cost vs benefit

Thank You

KSTINSON@SMGH.CA