2. Desember 2020

# Field evaluation of Abbott Panbio ™ rapid antigen test (RAT)

Pilot, Oslo, November 2020

Hdir

FHI

Oslo Kommune/Aker teststasjon

OUS/Pandemilab

Noklus

# Evaluation complete 1. desember

- Evaluation completed from 30. oktober to 25. November
- Segregated into three studyarms
  - Determine analytical performance of the test kit.
  - Determine clinical sensitivity and specificity by comparing RAT analysis results with the gold standard laboratory PCR analysis on a sample material collected in a routine setting at COVID-19 test station in Oslo
  - Outbreak settings in Norway during the study period.
  - In addition, the general experiences applying the RAT tests and logistics was assessed.

# Experiences with testdevice and logistics

- Performing the RAT analyses in parallel to sampling for laboratory PCR test, reporting results, and dissemination of test results to the patient was time consuming and stressful in an already busy test-station
- Need for training and dedicated personnel to perform RATs and reporting results and adequate facilities

# Analytical sensitivity

- 3991 samples from a test station in Oslo and 866 samples from outbreaks
  - Largest clinical evaluation, and in low to middle prevalence setting (6.3%)
- The Panbio RAT had a detection limit corresponding approximately to 1.4 million copies/mL
  - Average viral load in infected persons: 10 million copies/mL (range from more than 240 billion copies/mL to less than one copy/mL)
  - Scientific consensus that virus load less than aproximately 1 million copies/mL pose very little risk of virus transmission between humans.
- Detection lim or the gold standard real-time PCR laboratory diagnostic method was between 1,000-10, 000 copies/mL

# Descriptive data of samples

- 36% have had exposure
  - 9.8% PCR positives
- 62% had symptoms,
  - 87% of these less than six days.
    - 8,3% PCR positives

Descriptive characteristics of persons tested at Aker test station during the study period.

| | Total | PCR negative (row %) | PCR positive (row %) |
|---|---|---|---|
| n | 3991 | 3741 (93.7) | 250 (6.3) |
| Exposed | | | |
| No | 2234 | 2143 (95.9) | 91 (4.1) |
| Yes | 1423 | 1284 (90.2) | 139 (9.8) |
| Unknown | 325 | 305 (93.9) | 20 (6.2) |
| Missing | 9 | 9 (100) | 0 |
| Symptoms | | | |
| No | 1408 | 1361 (96.7) | 47 (3.3) |
| Yes | 2475 | 2276 (92.0) | 199 (8.0) |
| Unknown | 101 | 97 (96.0) | 4 (4.0) |
| Missing | 7 | 7 (100) | 0 |
| Symptom duration | | | |
| ≤ 5 days | 2143 | 1965 (91.7) | 178 (8.3) |
| > 5 days | 327 | 306 (93.6) | 21 (6.4) |
| Unknown | 5 | 5 (100) | 0 |

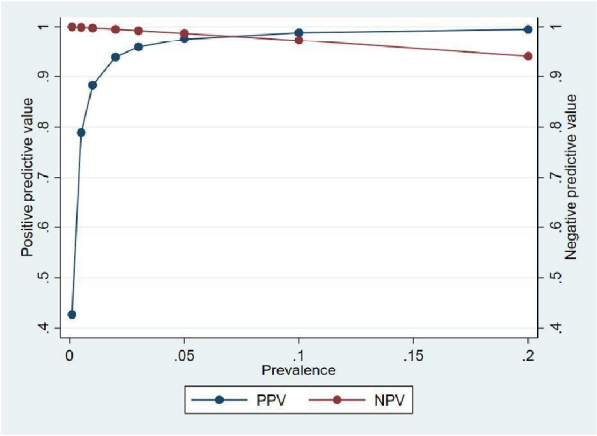
# Definitions

- **Sensitivity** is the ability of a test to find cases
- **Specificity** is the ability of a test to avoid false positives and rule out disease
- **Positive predictive value (PPV)** is the ability of the test to correctly label people who test positive to actually have the disease/are infected.
- **Negative predictive value (NPV)** is the ability to correctly label people who test negative does not have the disease/are not infected.

- The positive predictive value (PPV) is one of the most important measures of a diagnostic test.

# PPV and NPV resultater

- **The positive predictive value (PPV) was 0.984, while the negative predictive value (NPV) was 0.983.**
  - **98.4% of the RAT+ cases were true positives**
  - **98.3% of the RAT- cases were true negatives**
- PPV and NPV are affected by variations in prevalence rates of SARS-CoV-2 given a sensitivity of 74.4 % and a specificity of 99.9 %. A sharp decrease in PPV at prevalence rates below 1 % is demonstrated



# False positives and negatives

- 3 false positives (1.2%)
- 64 false negatives (1.7%)
  - Viral load was lower among cases with negative RAT, the mean ct-value equaled the threshold for infectivity
    - 47% of the false negatives had more than 1 million copies/mL
    - out of those with symptoms more than half had symptoms lasting less than five days

| | Total | RAT negative (row %) | RAT positive (row %) | p-value* |
|---|---|---|---|---|
| **n** | 250 | 64 (25.6) | 186 (74.4) | |
| **Exposed** | | | | |
| No | 91 | 21 (23.1) | 70 (76.9) | 0.469 |
| Yes | 139 | 38 (27.3) | 101 (72.7) | |
| Unknown | 20 | 5 (25.0) | 15 (75) | |
| **Symptom** | | | | |
| No | 47 | 21 (44.7) | 26 (55.3) | < 0.001 |
| Yes | 199 | 42 (21.1) | 157 (78.9) | |
| Unknown | 4 | 1 (25.0) | 3 (75.0) | |
| **Symptom duration** | | | | 0.375 |
| ≤ 5 days | 178 | 36 (20.2) | 142 (79.8) | |
| > 5 days | 21 | 6 (28.6) | 15 (71.4) | |
| **ct values** | | | | |
| Mean (SD) | 25.8 (4.7) | 29.9 (4.7) | 24.4 (3.9) | < 0.001 |
| Median | 25.3 | 29.8 | 23.8 | |
| Min - Max | 16.16 - 38.99 | 17.5 - 38.27 | 16.16 - 38.99 | |

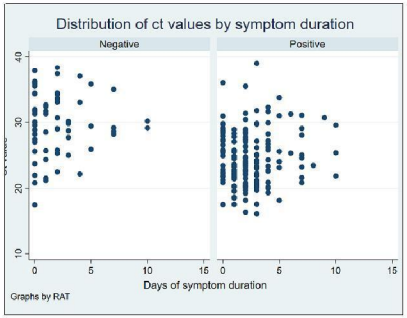
# Clinical sensitivity of RAT

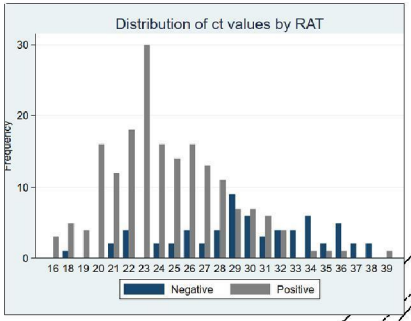
- Specificity: 99.9%
- Sensitivity:
  - Overall sensitivity: 74.4%
    - >1million copies/mL: 83.8%
  - Symptomatic: 78.9%
    - Symptoms less than 6 days:79,8%
  - No symptoms: 55,3%
  - Exposed: 72.7%

| | RAT neg (n) | RAT pos (n) | Total (n) | Sensitivity (%) | CI 95 % (%) |
|---|---|---|---|---|---|
| PCR positive | 64 | 186 | 250 | 74.4 | 69 - 79 |
| PCR negative | 3738 | 3 | 3741 | | |
| ct < 30 | 33 | 171 | 204 | 83.8 | 78 - 88 |
| ct ≥30/neg | 3769 | 18 | 3787 | | |
| PCR positive symptomatic | 42 | 157 | 199 | 78.9 | 73 - 84 |
| PCR positive symptom duration ≤5 days | 36 | 142 | 178 | 79.8 | 73 - 85 |
| PCR positive symptom duration > 5 days | 6 | 15 | 21 | 71.4 | 50 - 86 |
| Asymptomatic PCR positive | 21 | 26 | 47 | 55.3 | 41 - 69 |
| Exposed PCR positive | 38 | 101 | 139 | 72.7 | 65 - 79 |

# Clinical sensitivity of RAT

- Presence of COVID-19 symptoms, but not the duration of symptoms, was significantly associated with a positive RAT result ($p < 0.001$).
- Significantly higher viral load in RAT+ compared to RAT-
  - Still both cases with low and high viral load was detected in both groups
- Median PCR ct-value for a RAT negative test was 29,8 which equals the 1 million copies/mL detection limit



# Evaluation in outbreak settings

- Six Norwegian municipalities were included
- 866 RATs were performed, 60 PCR positives and no false positive RATs (100% specificity). 43 RAT positives (sensitivity 70%)

# Conclusions

- **98.4% of the RAT+ cases were true positives**
- **98.3% of the RAT- cases were true negatives**

- ~76% of all PCR positive cases in Oslo since August have been in the viral load range of detection of the RATs.
- The majority of infectious cases can be correctly identified with RAT. Nevertheless, false negative results, underscores that negative test results should be interpreted with caution in certain situations.
- Lower sensitivity in the low prevalence settings (outbreaks), and our analyses illustrate how the PPV falls drastically when the prevalence is low (under 1%).
- Sensitivity was 87.6 % for patients with less than five days of symptoms and a high viral load above the suggested infectivity threshold of $10^6$ copies/mL
- For non-symptomatic individuals, sensitivity of the Panbio RAT was low (55.3 %), indicating that it is best suited for symptomatic patients
  - Pre-symptomatic or late phase? Repeated testing?

- RAT testing is suitable and an important strengthening measure for outbreak control and management of the pandemic in addition to laboratory PCR methods, but they have to be used wisely