First results of an international external quality assessment pilot scheme for SARS-CoV-2 antigen detection

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Introduction

Labquality, a Finnish independent provider of external quality assessment (EQA), responded to the urgent need for proficiency testing (PT) for methods detecting SARS-CoV-2 by arranging international EQA pilot studies for nucleic acid detection, antibody detection and most recently for antigen detection. The response from participants was very positive and we organized altogether eight SARS-CoV-2 EQA rounds during 2020 including more than 850 participants.

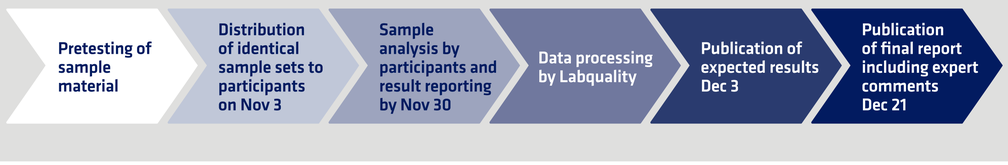
Background

Rapid SARS-CoV-2 antigen tests have been developed by several manufacturers during the COVID-19 pandemic to complement the gold standard of reverse transcription polymerase chain reaction (RT-PCR) which detect SARS-CoV-2 virus in patient samples. The majority of the SARS-CoV-2 Ag tests are rapid immunoassays intended for qualitative detection of SARS-CoV-2 specific antigens directly from a nasopharyngeal or nasal swab specimen. Most antigen tests are designed to target the nucleocapsid (N) protein because of its relative abundance in the virus. Antigen tests detect the presence of viral antigen in the patient sample without amplification, therefore showing lower sensitivity as compared to PCR tests, but the specificity is generally high. The minimum performance requirements for SARS-CoV-2 antigen detecting rapid diagnostic tests set by WHO is ≥80% sensitivity and ≥97% specificity [1].

SARS-CoV-2 antigen tests are performed both in laboratory settings and at point-of-care sites. Appropriate quality controls are needed in both cases. Participation in EQA schemes should be part of the quality routine to ensure high quality and reliable test results. Labquality successfully performed an international pilot study for SARS-CoV-2 antigen detection in November 2020.

Materials and methods

Timeline of Labquality SARS-CoV-2 antigen detection pilot



Samples: Positive (S001) and negative (S002) samples containing a proprietary excipient matrix formulation desiccated on swabs. In addition, the positive sample S001 included synthetic SARS-CoV-2 nucleocapsid protein designed to mimic a strong positive patient sample corresponding to ca 691 $TCID_{50}$ /mL equivalents based on titration with a leading SARS-CoV-2 antigen assay, as reported by the sample manufacturer.

Sample pretesting: Performed by an ISO certified testing site using the mariPOC SARS-CoV-2 test (ArcDia Ltd, Finland)

Sample storage, stability and shipment: Samples were stored at +4 °C and shipped at ambient temperature conditions to the participants. Samples are stable at +2 - +30 °C.

Instructions for participants: Swabs were to be placed into a specimen collection tube or transport media to dislodge the material and analysis was to be performed according to the instructions of their test manufacturer. Results and test methods were to be reported through Labquality's electronic LabScala portal for processing.

Test used by participants in SARS-CoV-2 Antigen pilot study

Name of test	Manufacturer	Number of users
BinaxNOW COVID-19 Ag Card	Abbott	1
Panbio COVID-19 Ag Rapid Test Device	Abbott	13
AMP Rapid Test SARS-CoV-2 Ag	AMP Diagnostics	1
mariPOC Respi+	ArcDia	2
mariPOC SARS-CoV-2	ArcDia	9
NowCheck COVID-19 Ag Test	BioNote	1
BIOSYNEX COVID-19 Ag BSS	BIOSYNEX	1
LIAISON SARS-CoV-2 Ag	DiaSorin	1
SARS-CoV-2 Antigen ELISA	EUROIMMUN	1
Lumipulse G SARS-CoV-2 Ag	Fujirebio	1
LumiraDx SARS-CoV-2 Ag Test	LumiraDx	3
Coronavirus Ag Rapid Test Cassette	Menarini Diagnostics	1
NADAL COVID-19 Ag Rapid Test	Nal von Minden	2
VITROS SARS-CoV-2 Antigen Test	Ortho Clinical Diagnostics	1
SARS-CoV-2 Rapid Antigen Test	Roche	1
QuickStripe SARS-CoV-2 Antigen Test	Savyon Diagnostics	1
STANDARD F COVID-19 Ag FIA	SD BIOSENSOR	5
STANDARD Q COVID-19 Ag Test	SD BIOSENSOR	5

Results

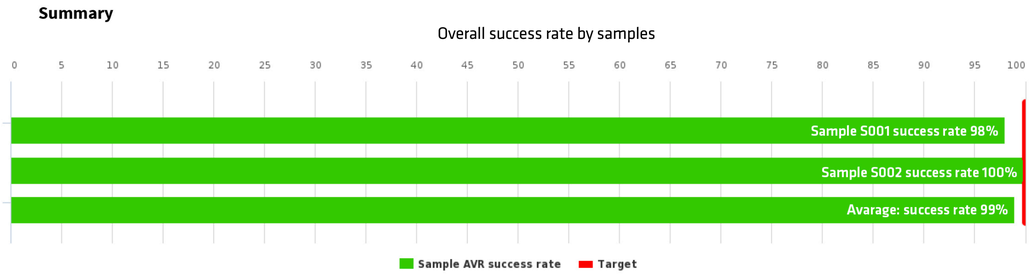
Summary of SARS-CoV-2 antigen pilot study

47 Participants
16 Countries
50 Number of responses
18 Participating assays
98% Success rate for positive sample S001
100% Success rate for negative sample S002

With two non-responders and three participants reporting results from two test panels, altogether 50 results from 18 different tests were reported with qualitative interpretations (positive, negative). The success rate for the positive sample S001 was 98% with one participant reporting a false negative result. The success rate for the negative sample S002 was 100%. Below is a capture from the LabScala Global report distributed to all participants in addition to the participant specific reports.

			Response percentage
SARS-CoV-2 antigen detection, November, 1-2020			95.7 %

Summary



Summary	AVR success rate
Sample S001	98 %
Sample S002	100 %
Average:	99 %

Conclusion

- **The results of Labquality's first EQA pilot study for SARS-CoV-2 antigen detection were excellent. The performance assessment was based on qualitative results reported compared to the expected value. One participant failed to detect the positive sample due to reasons unknown.**
- **Based on pretesting and results obtained in the pilot study, the samples can be considered homogenous, stable and suitable to be used as EQA samples.**
- **This qualitative EQA study does not provide direct information about the sensitivity between different tests in clinical use, however, it gives important information about the participant's performance compared to other test sites and helps identifying improvement needs in the analysis process.**
- **Based on the results of the pilot study, EQA rounds for antigen detection have been included in the EQA program at Labquality and further data on the performance of SARS-CoV-2 antigen tests will be obtained.**

Keywords: SARS-CoV-2, EQA, PT, Antigen test

1.https://www.who.int/publications/m/item/covid-19-target-product-profiles-for-priority-diagnostics-to-support-response-to-the-covid-19-pandemic-v.0.1