FIND Evaluation of LumiraDx SARS-CoV-2 Ag Test External Report

Version 2.0, 8 October 2021

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Evaluation process – private sector engagement

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More information on our policy and guidelines for working with private sector partners can be found here: https://www.finddx.org/policies/

For the COVID-19 response, FIND has commissioned independent evaluations of in vitro diagnostics following an Expression of Interest (EOI) process available on FIND's website by which all test submissions were scored according to their regulatory status and time to market; the manufacturing and distribution capacity of the supplier; and the supplier-reported clinical and analytical performance.

Document history

Document version	Date	Comment
1.0	16 August 2021	Initial version with results from Germany
2.0	8 October 2021	Version with results from Brazil added

1 Product Info:

Manufacturer name	LumiraDx
Test name	SARS-CoV-2 Ag Test
Product code(s)	L016000101012 (12) L016000101024 (24). L016000101048 (48) for EN, FR, DE, IT, NL, ES L016000102012 (12) L016000102024 (24) L016000102048 (48) for EN, NO, FI, DK, SE L016000109012 (12), L016000109024 (24), L016000109048 (48) US EUA
Pack size(s)	12/24/48 Test Strips per kit
Contents of kit	Test strips in sealed desiccant foil pouches, test product insert, RFID (Radio frequency ID) Tag held inside the test strip carton, extraction buffer vials, dropper lids
Equipment and consumables required, but not provided	Equipment: LumiraDx Instrument Consumables: Nasal/nasopharyngeal swabs, LumiraDx SARS-CoV-2 Quality Controls, PPE
Product storage (temperature range)	2-30°C
Shelf-life (months)	10 Months
Manufacturing site (country)	LumiraDx UK Ltd, Dumyat Business Park, Alloa, FK10 2PB, UK. Registration number: 09206123

2 Study details:

Study design:	Prospective diagnostic evaluation studies across multiple, independent sites to determine the accuracy of COVID-19 antigen RDTs, using consecutive enrolment. Interim analyses are performed at 25% and 50% enrolment, and the evaluation is stopped if tests do not meet 95% specificity. Presence of symptoms, date of symptom onset and hospitalization status is collected for all enrolled participants. Patient self-collected or HCP collected swabs used .

Index assays:	Novel microfluidic Antigen Test that detect recombinant SARS-CoV-2 antigens.
Reference method:	Results of the index test are compared to the routine, diagnostic RT-PCR result, which is used for clinical management
Limit of detection:	Analytical sensitivity, i.e. Limit of detection, was performed at the Liverpool School of Tropical Medicine in which standardized serial dilutions of cultured viral isolate were prepared. Viral dilution was applied directly to the test strip, not to the provided swab. Dilutions were tested in triplicate and the LOD was defined as the last dilution where all repeats were interpreted as positive.
Clinical performance:	Sensitivity was calculated as the proportion of true positive results detected by LumiraDx SARS-CoV-2 Ag Test among all positives by the reference method, and reported as a percentage Specificity was calculated as the proportion of true negative specimens, identified as negative by LumiraDx SARS-CoV-2 Ag Test among all negatives by the reference method and reported as a percentage. The 95% confidence intervals were calculated to assess the level of uncertainty introduced by sample size, using the Wilson's score method.
Ease of use	A System usability survey and ease of use questionnaire assessing the quality of the test, test preparation, ease of test execution, procedure time, ease of result interpretation, storage conditions and perceived settings of use was completed by operators and a final score out of 100 was calculated.

3 Evaluation details:

Country of collaborator	Germany	Brazil
Location of clinical site(s) (city, town)	1. Heidelberg (HD) 2. Berlin	Center for COVID-19 Diagnosis at the Federal University of Rio de Janeiro (CTD-UFRJ)
Health care level of site(s)	1. Heidelberg: Drive-in testing Center 2. Berlin: Ambulatory testing clinic of Charité – University Hospital	Community testing clinic
Study period (date to date)	2-27 November 2020	22 July - 2 August 2021

Study cohort inclusion/exclusion	Adults able to ambulate and meeting suspect definition of the Department of public health Provided informed consent	Adults in community meeting national suspect definition Provided informed consent
Sample type, antigen test	Nasal mid turbinate patient self collected (Nasal)*	Nasal anterior (Nasal)
Reference PCR method	• Cobas SARS-CoV-2 (Roche Diagnostics Inc) ○ N = 26 • Abbott *RealTime* SARS-CoV-2 (Abbott Molecular, Inc) ○ N = 7 • Allplex 2019-nCov Assay (Seegene Inc) ○ N = 467 • LightMix® Modular SARS-CoV (COVID19) E-gene (Tib Molbiol) ○ N = 62 • RealStar SARS-CoV-2 RT-PCR kit (Altona Diagnostics) ○ N= 7 • Cobas or Tib Molbiol ○ N=192	Lab-developed assay based on the US CDC protocol, which targets two regions (N1 and N2) of the nucleocapsid (N) gene of SARS-CoV-2 (https://www.fda.gov/media/134922/download)
Sample type, PCR test	Nasopharyngeal swab (NP)	Nasopharyngeal swab (NP)

* ***Important note****: the study conducted in Germany was performed using self-collected swabs and not professionally collected swabs as described in the study design of all the other FIND independent test evaluations*

4 Results:

4.1 Study cohort

Country	**Germany**	**Brazil**
Total N (valid PCR results)	761	251
Age [mean (min-max), N]	38.5 (18-90), 761	36.7 (19-75), 251
Gender [%F, (n/N)]	52.2%, (396/759)	64.9% (163/251)

Symptoms present [%Yes, (n/N)]	62.2%, (487/758)	97.2%, (243/250)
Swab Collection Method	Patient self-swab	HCP collected
Hospitalized (n, % Yes)	Not applicable	Not applicable
Days from symptom onset [median (Q1-Q3); N]	3 (2-5); 476	3 (2-5); 243
Days < 0-3 (n, %)	258, 54%	130, 53%
Days 4-7 (n, %)	166, 35%	108, 44%
Days 8+ (n, %)	52, 11%	5, 2%
Positivity [%, (n/N)]	19%, (146/761)	23%, (58/251)
PCR Ct [median (Q1-Q3); N]	22.9 (19.5-27.7), 146	17.43 (15.1-21.6), 58
Ct > 33 (n, %)	13, 2%	1, 2%
Ct > 30 (n, %)	24, 3%	4, 7%
Ct > 25 (n, %)	51, 7%	7, 12%

4.2 Estimation of Clinical Performance

Country	**Germany**	**Brazil**
Clinical Sensitivity (95% CI), N	82.2% (75.2, 87.5), 146	86.2% (75.1, 92.8), 58
Sensitivity days ≤7, N	86.4% (79.1, 91.5), 118	85.7% (74.3, 92.6), 56
Sensitivity Ct ≤ 33, N	87.2% (80.5, 91.9), 133	87.7% (76.8, 93.9), 57
Sensitivity Ct ≤ 25, N	92.6% (85.6, 96.4), 95	94.1% (84.1, 98), 51
Clinical Specificity (95% CI), N	99.3% (98.3, 99.7), 615	99% (96.3, 99.7), 191
Invalid rate (%, n/N)	0% (0/761)	0.8% (2/251)

4.2.1 Estimation of analytical performance

Variant (lineage)	Lowest dilution detected	Verified LOD concentration	Viral Copy equivalent	Supplier-reported LOD
UK wild type (B1)	**1.0 x10^2 pfu/ml ~** 1.41 x 10^3 $TCID_{50}$/ml	**1.0 x10^2 pfu/ml**	1.36 x10^4 **copies/ml** applied to test	**32 $TCID_{50}$/ml**

Alpha (B.1.1.7)	**5.0 x10^2 pfu/ml** ~ 7.05 x 10^3 $TCID_{50}$/ml	**5.0 x10^2 pfu/ml**	1.82 x10^4 **copies/ml** applied to test	Not reported
Gamma (P1)	**1.0 x10^2 pfu/ml** ~ 1.41 x 10^3 $TCID_{50}$/ml	**1.0 x10^2 pfu/ml**	4.30 x10^4 **copies/ml** applied to test	Not reported
Delta (B.1.617.2)	**2.5 x10^1 pfu/ml** ~ 3.52 x 10^3 $TCID_{50}$/ml	**2.5 x10^1 pfu/ml**	4.09 x10^4 **copies/ml** applied to test	Not reported

Note: viral dilution was applied directly to the test strip

4.3 Ease of use

LumiraDx SARS-CoV-2 Ag Test	65 out of 100	5 operators, Germany