Electronic Supplementary Information (ESI) for:

Point-of-Care Diagnostics: Recent Developments in a Pandemic Age

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Data acquisition methods for figures in main text:

Figure 3:

Data on the number of over-the-counter (OTC) test approvals from 1990 to 2020 was obtained from the U.S Food and Drug Administration (FDA) Over the Counter database.¹ Data was collected for each year individually, by setting the effective date from January 1st to December 31st, exporting search results to a spreadsheet, and enumerating the list.

Figure 4:

All data in this figure was acquired as of September 26, 2021.

For Figure 4A, data on in vitro diagnostics (IVDs) that received emergency use authorization (EUA) in previous public health emergencies was compiled from the FDA website. Information on the current EUAs in place and the tests authorized for each can be found here.^{2,3} Information on IVDs that have had their EUA revoked, including tests developed for H1N1 influenza (no current EUA in place), can be found here.⁴ Tests were compiled and grouped under assay type (nucleic acid, antigen, antibody) in Microsoft Excel 2019, and graphed in GraphPad Prism 9. The "Other" category for SARS-CoV-2 IVDs includes laboratory developed nucleic acid tests, T-cell tests, and IVDs for management of COVID-19 patients (3 tests detecting Interleukin-6).⁵

For Figure 4B, data on current EUAs for SARS-Cov-2 IVDs was compiled from FDA databases covering the three main assay types (nucleic acid⁶, antigen⁷, antibody⁸). Data on the authorized setting was also compiled from the same databases. Non-POC designates tests authorized to be utilized in laboratories certified under the Clinical Laboratory Improvement Amendments of 1988 (CLIA), 42 U.S.C. §263a, that meet requirements to perform high and moderate complexity tests (H,M). Tests that are categorized as N/A were also included in this category (e.g., collection kits). POC designates tests authorized to be utilized in patient care settings operating under a CLIA Certificate of Waiver (W). Home/OTC designates tests authorized for home-use and available OTC. Note, the home and OTC categories are grouped together as all tests currently approved for home-use are also available OTC. Additionally, all tests were categorized by their most restricted authorized setting, and only tests on the same platform that detect another target (e.g., includes Influenza) were counted more than once in the analysis. All data was compiled in Microsoft Excel 2019 and graphed in GraphPad Prism 9. For more information on the tests included in each category see **Supplementary Table 3**.

Figure 5:

All data in this figure was acquired as of July 15, 2021.

Data on the company founding date was collected from various web searches on google.com. In order to obtain the time (in months) for each company to receive an initial EUA from the FDA, the dates for the company's first FDA EUA were recorded using the FDA databases.^{6–8} The time from the initial declaration of the EUA pathway by the FDA (February 4th, 2020) was then calculated and utilized in the analysis. Information on US federal funding was restricted to three sources, National Institutes of Health (NIH) Rapid Acceleration of Diagnostics (RADx)

initiative, Biomedical Advanced Research and Development Authority (BARDA), and the Department of Defense (DoD). For RADx, and BARDA numbers were taken from their respective websites which list funding given to various companies during the COVID-19 pandemic.^{9,10} Information on DoD funding was obtained from various press releases from both the DoD and individual companies. Data was collected, and aggregated in Microsoft Excel 2019 and plotted using GraphPad Prism 9.

Figure 7:

All data in this figure was acquired as of September 26, 2021.

Using the FDA databases on IVDs that received EUA,⁶⁻⁸ POC diagnostic platforms were grouped based on their use case (described in main text). The analysis done here was based solely on the platform, therefore platforms with multiple tests were only included once in the analysis. See **Supplementary Table 4** for a breakdown of the tests included in each category.

Supplementary Tables:

Test Name	Sensitivity (95% CI)	Specificity (95% CI)	Sample Type	Reported Limit of Detection (LOD)	Sample Type	LOD with FDA Reference Panel
					Purified RNA	
Abbott ID NOW	100%	100%	Contrived NP	125 genome	diluted in NP	3x 10 ⁵
COVID-19	(83.9 -100%)	(88.7 -100%)	swabs	equivalents/mL	matrix	NDU/mL
Mammoth Biosciences SARS-CoV-2 DETECTR kit	95% (83.5 - 98.6%)	100% (94.2 -100%)	Clinical NP swabs (prospective)	20 copies/µL (20,000 copies/mL)	AccuPlex Verification Panel Reference material diluted in NP matrix	5.4x 10 ⁵ N DU/mL
Sherlock Biosciences Sherlock CRISPR	100%	100%	Contrived NP	6.75 copies/µL	Extracted RNA diluted in NP	0.6x10 ⁴
SARS-CoV-2 kit	(83.9 -100%)	(88.6 -100%)	swabs	(6,750 copies/mL)	matrix	NDU/mL
Mesa Biotech Accula SARS-	95.8%	100%	Clinical nasal swabs		Heat inactivated virus diluted in	4.75x 10 ²
CoV-2 Test	(78.9 -99.9%)	(86.7 -100%)	(retrospective)	150 copies/mL	nasal matrix	NDU/mL
Visby Medical COVID-19 Point of Care Test	100% (89.0 -100%)	95.30% (87.1 -98.4%)	Clinical NP swabs (prospective)	435 copies/swab	Inactivated virus diluted in NP matrix	5.4x 10 ⁴ NDU/mL
Roche cobas liat SARS-CoV-2 & Influenza A/B	100% (93.6 -100%)	100% (98.4 -100%)	Clinical NP swabs (prospective)	12 copies/mL	Heat inactivated virus diluted in NP matrix	5.4x 10 ³ NDU/mL
Lucira Health CHECK-IT COVID-19 Test Kit	91.7% (85.6 - 95.8%)	98.2% (95.8 - 99.4%)	Clinical nasal swabs (prospective)	2700 copies/swab (900 copies/mL)	Heat inactivated virus diluted in nasal matrix	N/A
Cue Health COVID-19 Test	97.4% (86.5 -99.5%)	99.1% (96.9 – 99.8%)	Clinical nasal swabs (prospective)	1.3 genome copies/µL (1,300 copies/mL)	Viral RNA diluted in nasal matrix	6 x 10 ⁴ NDU/mL (Dry Swab)
Cepheid Xpert Xpress SARS- CoV-2	97.8% (88.4 - 99.6%)	95.6% (85.2 - 98.8%)	Clinical NP swabs (retrospective)	0.02 PFU/mL	Live virus diluted in NP swab matrix	5.4x 10 ³ NDU/mL

Supplementary Table 1: Company reported performance metrics for POC nucleic acids tests discussed in main text:

BioFire Filmarray					Heat inactivated	
Respiratory Panel	98.40%	98.9%	Clinical NP swabs		virus diluted in	$6.0x \ 10^3$
2.1-EZ	(91.4 - 99.7%)	(97.5 - 99.5%)	(prospective)	500 copies/mL	NP swab matrix	NDU/mL
					Heat inactivated	
Cepheid Omni	97.6%	99.1%	Clinical NP swabs		virus diluted in	
SARS-CoV-2	(91.5 - 99.3%)	(94.8 - 99.8%)	(prospective)	400 copies/mL	NP swab matrix	N/A

Note: All performance metrics were obtained from Instruction for Use (IFU) documents from FDA EUA database. NDU stands for RNA NAAT detectable units and is further defined here on the FDA website.¹¹

Test Name	Sensitivity (95% CI)	Specificity (95% CI)	Sample Type	Reported Limit of Detection (LOD)	Sample Type
					Heat inactivated virus
Quidel Sofia SARS	96.70%	100%	Clinical nasal swabs	1.13×10^2	diluted in nasal swab
Antigen FIA	(83.3 - 99.4%)	(97.9 -100%)	(prospective)	TCID ₅₀ /mL	matrix
Quidel QuickVue At-					Heat inactivated virus
Home COVID-19	83.5%	99.2%	Clinical nasal swabs	1.91×10^4	diluted in nasal swab
Test	(74.9 - 89.6%)	(97.2 -99.8%)	(prospective)	TCID ₅₀ /mL	matrix
Abbott BinaxNOW					Heat inactivated virus
COVID-19 Ag Card	91.7%	100%	Clinical nasal swabs	140.6	diluted in nasal swab
Home Test	(73.0 - 98.9%)	(87.7 - 100.0%)	(prospective)	TCID ₅₀ /mL	matrix
					Heat inactivated virus
Ellume COVID-19	95%	97%	Clinical nasal swabs	10 ^{3.8} (6,310)	diluted in NP swab
Home Test	(82 - 99%)	(93 - 99%)	(prospective)	TCID ₅₀ /mL	matrix
Luminostics CLIP					Gamma irradiated
COVID Rapid	96.9%	100%	Clinical nasal swabs	$0.88 \ge 10^2$	virus diluted in nasal
Antigen Test	(83.8 - 99.9%)	(97.3 – 100%)	(prospective)	TCID ₅₀ /mL	swab matrix
					Gamma irradiated
LumiraDx SARS-	97.6%	96.6%	Clinical NP swabs	32	virus diluted in nasal
CoV-2 Ag Test	(91.6 - 99.3%)	(92.7 - 98.4%)	(prospective)	TCID ₅₀ /mL	swab matrix
BD Veritor System					Gamma irradiated
for Rapid Detection	84%	100%	Clinical nasal swabs	1.4×10^2	virus diluted in nasal
of SARS-CoV-2	(67 - 93 %)	(98 - 100%)	(prospective)	TCID ₅₀ /mL	swab matrix
					Gamma irradiated
BD Veritor At-Home	84.6%	99.8%	Clinical nasal swabs	1.87×10^5	virus diluted in nasal
COVID-19 Test	(70.3 - 92.8%)	(99 - 100%)	(prospective)	TCID ₅₀ /mL	swab matrix

Supplementary Table 2: Company reported performance metrics for POC antigen tests discussed in main text:

Note: All performance metrics were obtained from Instruction for Use (IFU) documents from the FDA EUA database.

Supplementary Table 3: SARS-CoV-2 POC IVDs that have received EUA, grouped by their authorized setting (Figure 4B)

Test Type	Authorized Setting	Test Name
		Visby Medical COVID-19 Point of care Test
		Mesa Biotech Accula SARS-CoV-2 Test
		Cepheid Xpert Xpress SARS-CoV-2/Flu/RSV
		Cepheid Xpert Xpress SARS-CoV-2/Flu/RSV plus
		Cepheid Xpert Xpress SARS-CoV-2 test
		Cepheid Xpert Omni SARS-CoV-2
NT 1 '	CLIA waived	Cepheid Xpert Xpress SARS-CoV-2 DoD
Nucleic	laboratories (POC)	BioFire Respiratory Panel 2.1-EZ (RP2.1-EZ)
Acid		Roche cobas SARS-CoV-2 & Influenza A/B Nucleic Acid
		Test for use on the cobas Liat System
		Roche cobas SARS-CoV-2 Nucleic Acid Test for use on the
		cobas Liat System
		Abbott ID Now COVID-19
		Lucira CHECK-IT COVID-19 Test Kit
	Home/OTC	Cue Health Cue COVID-19 Test
		BD Veritor System for Rapid Detection of SARS-CoV-2
		BD Veritor System for Rapid Detection of SARS-CoV-2 &
		Flu A+B
		LumiraDx SARS-CoV-2 Ag Test
	CLIA waived laboratories (POC)	Luminostics Clip COVID Rapid Antigen Test
		Quidel Sofia SARS Antigen FIA
		Quidel Sofia 2 Flu + SARS Antigen FIA
		Access Bio CareStart COVID-19 Antigen test
		Princeton BioMeditech Status COVID-19/Flu
		Celltrion DiaTrust COVID-19 Ag Rapid Test
		Salofa Oy Sienna-Clarity COVID-19 Antigen Rapid Test
Antigen		Cassette
0		InBios SCoV-2 Ag Detect Rapid Test
		Ellume Lab COVID Antigen Test
		GenBody COVID-19 Ag Test
		PHASE Scientific INDICAID COVID-19 Rapid Antigen
		Test
		Quidel QuickVue At-Home OTC COVID-19 Test
		Ellume COVID-19 Home Test
	Home/OTC	Abbott BinaxNOW COVID-19 Ag Card Home Test
		BD Veritor At-Home COVID-19 Test
		Access Bio CareStart COVID-19 Antigen Home Test
		Orasure InteliSwab COVID-19 Rapid Test
		Nirmidas Biotech MidaSpot COVID-19 Antibody Combo
		Detection Kit
	CLIA waived	ADVAITE RapCov Rapid COVID-19 Test
Antibody		Salofa Oy Sienna-Clarity COVIBLOCK COVID-19
	laboratories (POC)	IgG/IgM Rapid Test Cassette
		Hangzhou Biotest Biotech RightSign COVID-19 IgG/IgM
		Rapid Test Cassette

Assure Tech Assure COVID-19 IgG/IgM Rapid Test
Device
Sugentech SGTi-flex COVID-19 IgG
Megna Health Rapid COVID-19 IgM/IgG Combo Test Kit
NOWDiagnostics ADEXUSDx COVID-19 Test
InBios SCov-2 Detect IgG Rapid Test
Access Bio CareStart COVID-19 IgM/IgG
Diabetomics CovAb SARS-CoV-2 Ab Test
LumiraDx SARS-CoV-2 Ab Test
Access Bio CareStart EZ COVID-19 IgM/IgG

Supplementary Table 4: POC IVD platforms that have received EUA for a SARS-CoV-2 test, grouped by their most appropriate use case (Figure 7)

Assay Type	Use Case	Company Name/POC Platform	
Nucleic Acid	Premium Clinic	Biofire FilmArray 2.1	
		Roche cobas Liat	
	Premium/Economy Clinic	Cepheid GeneXpert*	
		Cepheid GeneXpert Omni	
	Economy Clinic	Mesa Biotech Accula	
		Abbott ID NOW	
	Premium Field	Visby Medical	
		Cue Health	
		Lucira Health	
		LumiraDx	
		BD Veritor Plus	
		Quidel Sofia 2	
	Economy Clinic	Qorvo Biotechnologies Omnia	
		Celltrion Sampinute	
		Ellume Lab	
		Ellume	
	Premium Field	Luminostics Clip	
		Abbott BinaxNOW	
Antigen		Quidel QuickVue	
8		Salofa Oy	
		Celltrion Diatrust	
		InBios International	
	Economy Field	Princeton Biomeditech	
		Access Bio CareStart	
		BD Veritor At Home	
		Orasure InteliSwab	
		Genbody	
		Phase Scientific INDICAID	
		QIAGEN QIAreach	
	Economy Clinic	LumiraDx	
	Economy Field	NOWDiagnostics ADEXUSDx	
		ADVAITE RapCoV	
		Sugentech SGTI-flex	
		Megna Health	
		Access Bio CareStart	
Antibody		Nirmidas Biotech	
Antibody		Beijing Wantai Biological Pharmacy	
		Enterprise Co. WANTAI	
		Salofa Ou Sienna-Clarity	
		Hangzhou Biotest Biotech Co. RightSign	
		ACON Laboratories	
		Hangzhou Laihe Biotech Co. LYHER	
		Innovita	
		Jiangsu Well Biotech Co. Orawell	

Xiamen Biotime Biotechnology Co., BIOTIME
Biohit Healthcare
Assure Tech
TBG Biotechnology Corp.
Biocan Diagnostics Tell Me Fast
Cellex
Healgen Scientific
InBios
Access Bio
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