

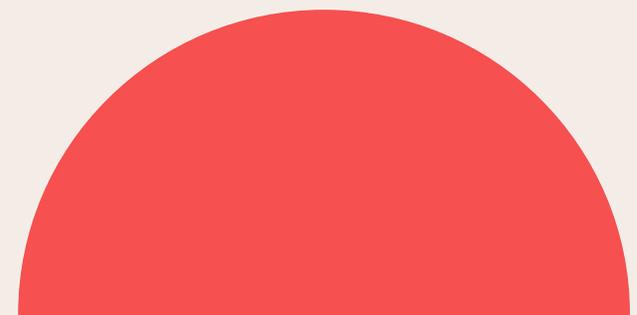
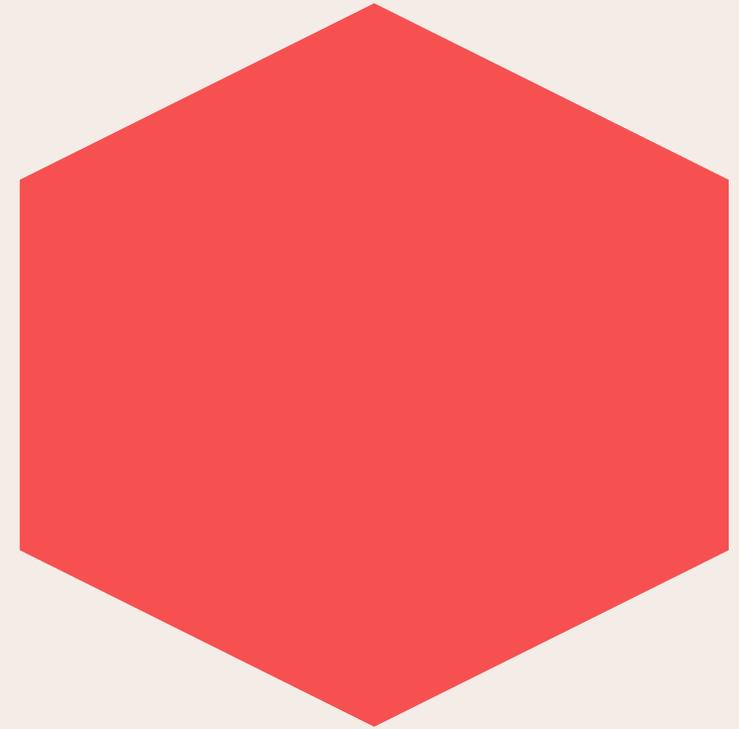
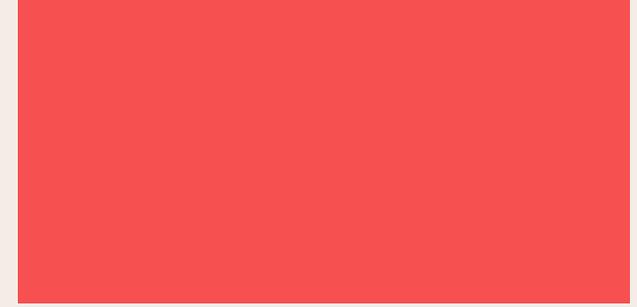
dSTARR Project

digital Solutions To support COVID-19 Antigen RDT Rollout

Stakeholder and Market Needs Assessment

Understanding stakeholder and market needs to inform the
development of digital solutions to support COVID-19 diagnostic testing

September 2021



- 1 **Overview of the assessment**
- 2 Summary and key themes
- 3 Country-specific findings

Background

ACTaccelerator
ACCESS TO COVID-19 TOOLS

FIND 
Diagnosis for all

PATH


Digital Solutions to Support COVID-19 Antigen RDT Rollout (dSTARR) Project

- **Goal:** To advance digital health solutions to improve data collection and mitigate current pain points associated with COVID-19 diagnostic testing in low- and middle-income settings
- **Aim:** To develop standards and enhance interoperability of patient and diagnostic data-collection platforms, driving the incorporation of these standards into leading mobile health tools in low- and middle-income settings

Objective

As a first step in this project, a global **stakeholder and market needs assessment** was conducted in Q2 to Q3 of 2021.

Objective

To understand stakeholder and market unmet needs associated with the current or future use of **COVID-19 antigen RDTs** (Ag RDTs) and identify opportunities to leverage digital solutions to address pain points.

Outcomes

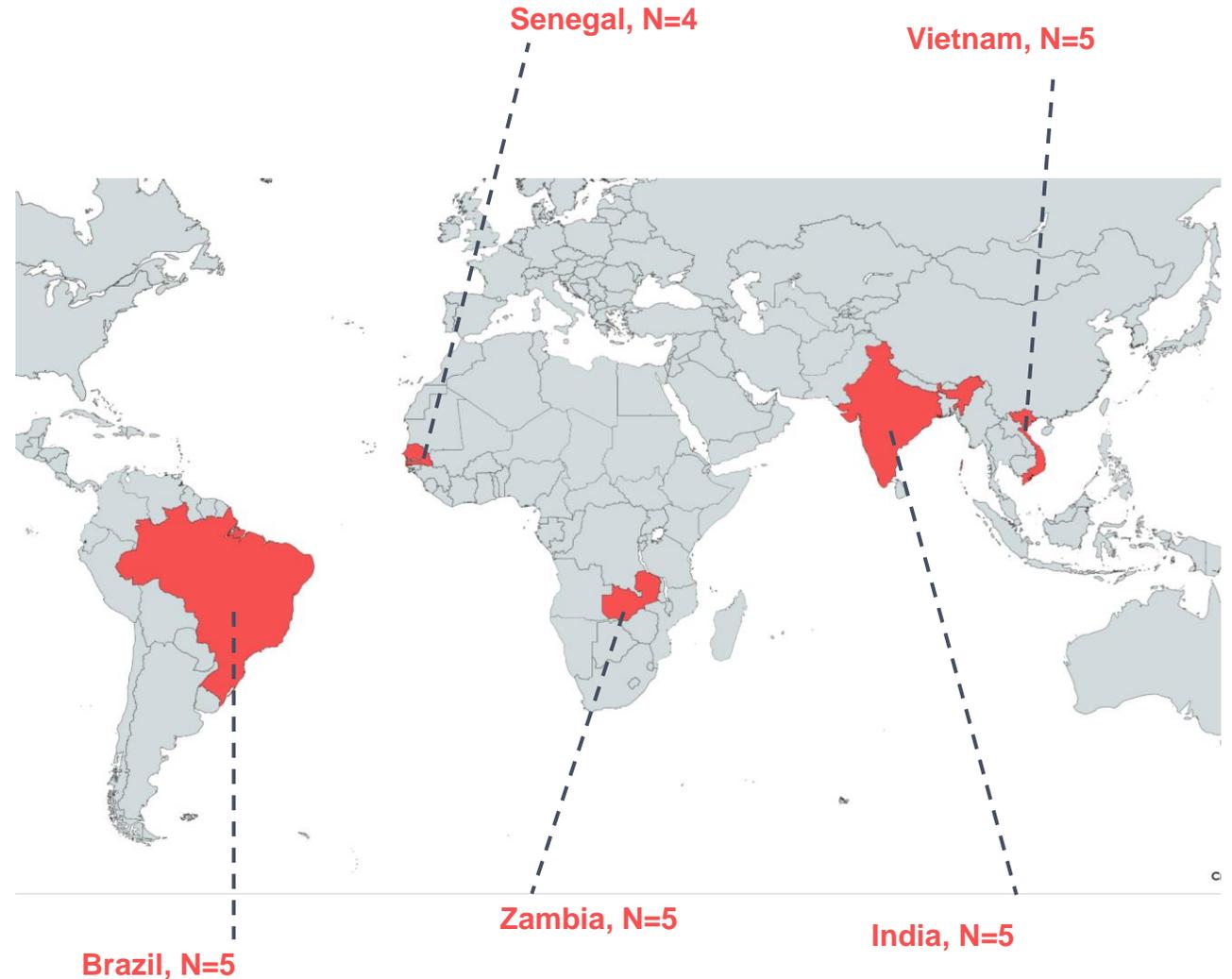
Findings of this assessment will be used to:

- **Align specifications** to unmet needs as defined by country stakeholders
- Identify **expanded use cases**, beyond data capture, for the digital solutions
- Inform the development of the **digital tool(s)** during subsequent project phases

Interview methods

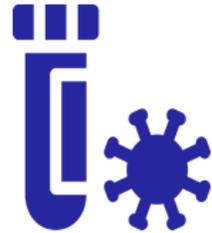
Between May and August 2021, key informant interviews were conducted with **24 stakeholders** in **five countries**.

- Interviewees were selected based on role alignment with interview topics
- Interviews were between **30 and 90 minutes** in length
- Interviews conducted in **local languages where possible**, including French, Portuguese, Vietnamese, and English
- Qualitative **interview guide** developed to understand the current COVID-19 diagnostic testing environment and how a digital solution could support Ag RDT rollout



Interview guide

Interview questions related to the following **themes**:



Status of COVID-19 diagnostic testing



Patient testing process



Provider procedure and training



Data reporting



Supply chains

Interviewees were also asked about their understanding of and experience with the country's digital health infrastructure and usage which is reflected in analysis of **Digital ecosystem**

Interview guide

The following **expanded use cases** for COVID-19 Ag RDT data-capture solutions were explored during the stakeholder interviews:



Summary of stakeholder participation

		 Policy/ Government	 Health care Admin	 Public health	 Laboratory	 Academia	 Industry	Total	
Brazil		2	-	2	-	1	-	5	<ul style="list-style-type: none"> • Rio de Janeiro's Municipal Health Secretariat • Department of Science and Technology, MOH • University of Brasilia • Tropical Medicine Foundation • Pan American Health Organization
India		-	1	3	-	1	-	5	<ul style="list-style-type: none"> • B. J. Medical College • Jalgaon Municipal Corporation • PATH
Senegal		-	1	1	2	-	-	4	<ul style="list-style-type: none"> • Bio24 • Health District of Thies • St. Louis and Richard Toll Health District
Vietnam		1	-	-	3	-	1	5	<ul style="list-style-type: none"> • Pasteur Institute in Ho Chi Minh City • Hospital for Tropical Diseases • National Institute of Hygiene and Epidemiology • Yen Bai Center for Disease Control • Viettel Solutions
Zambia		1	-	2	2	-	-	5	<ul style="list-style-type: none"> • Association of Public Health Laboratories • Ministry of Health (MOH) • Zambia National Public Health Reference Lab • Zambia National Public Health Institute • Clinton Health Access Initiative
Total		4	2	8	7	2	1	24	

- 1 Overview of the assessment
- 2 Summary and key themes**
- 3 Country-specific findings

What's working, what's not?

Qualitative success of specified capabilities in country

- High
- Neutral
- Low

	Brazil 	India 	Senegal 	Vietnam 	Zambia 
Number of Ag RDTs approved for use*	79	48	4	19	2
Referral support 	Neutral	Low	High	Neutral	Neutral
Patient management 	Low	Neutral	High	Low	Low
Overall clinical management 	High	High	Low	Neutral	High
Digital record keeping, reporting, surveillance 	Low	Neutral	Low	Low	Neutral
Capacity-strengthening 	Low	High	Neutral	Low	Low
Supply chain support 	High	Neutral	Neutral	Neutral	High
<i>Digital ecosystem</i>	High	High	High	Low	Low

*These numbers reflect the latest information that was publicly available or that PATH was able to solicit from country partners as of September 2021. The number of approved tests frequently changes as new data become available.

What's working, what's not?

Qualitative success of specified capabilities in country

- High
- Neutral
- Low

	Brazil 	India 	Senegal 	Vietnam 	Zambia 
Number of Ag RDTs approved for use*	79	48	4	19	2
Referral support 	Facility referral sometimes through WhatsApp	Disconnect between types of facilities	Strong referral system between public and private entities	Sample transfer for referral to other facilities not centralized	Lacking linkages between various facilities for referral
Patient management 	Various mobile platforms for results reporting but contact tracing and patient management often informal	Various mobile platforms for results reporting and contact tracing but prone to spread of misinformation	Existing mobile systems for results reporting but difficult to utilize due to volume of tests	Difficult to return test results with influx of cases and patients lack high-quality information or support	Inconsistent communication of results through mobile or in person
Overall clinical management 	Expansive network of care	Robust clinical and community management	Reliant on polymerase chain reaction (PCR) confirmatory testing	Differing data management systems across facilities	Immediate contact tracing if complete patient data are captured
Digital record keeping, reporting, surveillance 	Robust data management and reporting systems but requires duplicate entry within disconnected systems initially using paper-based forms	Centralized data management and reporting system but initially using paper-based forms	Lack of standardized data to be collected and initially using paper-based forms	Disjointed lab management systems but lack consistent internet connectivity for use	Multiple data collection tools and management systems but lacking data quality assurance
Capacity-strengthening 	Lacking centralized training and guidance	Centralized guidance exists but does not reach staff	<i>Lacking sufficient information in interviews</i>	Lacking centralized training and guidance	High turnover of staff and difficulty in adhering to guidance
Supply chain support 	Centralized system for procurement	Robust system for procurement but lacking demand forecasting	<i>Lacking sufficient information in interviews</i>	Supply estimation difficult and mandated bidding requirements	Multiple procurement channels working well together
<i>Digital ecosystem</i>	Strong usage of digital tools and information systems	Strong usage of digital tools and centralized online portal	Centralized system in use	Lacking infrastructure and strong network connectivity	Lacking infrastructure and strong network connectivity

*These numbers reflect the latest information that was publicly available or that PATH was able to solicit from country partners as of September 2021. The number of approved tests frequently changes as new data become available.



Brazil: What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital solution
Referral support 	<ul style="list-style-type: none"> - Referral (often through WhatsApp) of patients with positive results 	<ul style="list-style-type: none"> - Currently no digital platform for referral support 	<ul style="list-style-type: none"> - Municipal-level referral system integrated with Conecte SUS
Patient management 	<ul style="list-style-type: none"> - Using WhatsApp, telephone, and Conecte SUS to contact patients - Immediate reporting of Ag RDT results to patient at POC 	<ul style="list-style-type: none"> - Misinformation on COVID-19 testing and treatment (e.g., early use of serological tests) - Poor monitoring of contacts and compliance with self-isolation 	<ul style="list-style-type: none"> - Support contact tracing and monitoring of patients and close contacts - Communication to general public about testing - Integration with Conecte SUS
Overall clinical management 	<ul style="list-style-type: none"> - Various levels of care available to citizens 	<ul style="list-style-type: none"> - General population lack awareness regarding when to get tested - Multiple tests conducted for the same infection may be reported as new cases 	<ul style="list-style-type: none"> - Integration of data collected from Ag RDT and PCR testing across municipalities - Focus on primary care setting
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Healthcare workers (HCWs) can enter data into various systems to be aggregated 	<ul style="list-style-type: none"> - Use of paper systems at local level - Underreporting of cases - Parallel reporting, and non-standardized municipal systems - Variable reporting rates depending on the level of the health care professional - Incomplete information 	<ul style="list-style-type: none"> - Engaging with states and municipalities as it would be more difficult to harmonize a single information system at the national level - Integration of systems/databases - Asynchronous data capture for offline environments
Capacity-strengthening 	<ul style="list-style-type: none"> - In general, Ag RDT use is being implemented as per WHO guidelines 	<ul style="list-style-type: none"> - Limited time available for health professionals - Some HCW compliance challenges with testing guideline adherence 	<ul style="list-style-type: none"> - Support HCWs in best practices for conduct of Ag RDTs - Provide HCWs with real-time updates and reminders - Wider dissemination of remote/virtual trainings, building on local successes
Supply chain support 	<ul style="list-style-type: none"> - Centralized system for procurement of supplies 	<ul style="list-style-type: none"> - Appropriate use and stock control - Waste mitigation and accurate ordering 	<ul style="list-style-type: none"> - Municipality- and state-level reporting of supplies - Semi-automated inventory management at the facility level
Digital ecosystem	<ul style="list-style-type: none"> - General population own and use mobile technologies - Multiple data reporting systems exist - Cloud services for internal information exchange (Microsoft Teams, OneDrive) 	<ul style="list-style-type: none"> - Lack of resources for data analysis - Existing information systems not interoperable - Information systems have been adapted to fit local context hindering data sharing 	<ul style="list-style-type: none"> - Ability to connect disparate systems, such as Ag RDT and PCR results databases



Brazil: Key takeaways

The current status is

- Ag RDT usage has expanded capacity to allow for improved result turnover and contact tracing
- COVID-19 data reporting is mandated at the federal system (national e-SUS Notifica system) but inefficient due to parallel systems (primary health care and municipal systems) and overburdened HCWs

A new digital tool should

- Consider local specificities as opposed to national implementation, as information systems across municipalities are not standardized and inequities are context specific
- Be interoperable or able to interface with the many existing information and data management systems
- Allow for changing of content depending on local context

Digital tool developers should consider

- The structure of the numerous existing data management and information systems
- Focusing on HCWs at the primary health care level
- Innovative content within tools to allow for accurate and timely reporting of necessary information

India: What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital solution
Referral support 	<ul style="list-style-type: none"> - Hospital patients with positive Ag RDT immediately taken to intensive care unit (ICU) 	<ul style="list-style-type: none"> - No data link between lab test results and admission to hospital 	—
Patient management 	<ul style="list-style-type: none"> - Positive and negative results available to patients through phone, SMS, and/or online portal 	<ul style="list-style-type: none"> - Informing patients of results can be timelier and more streamlined - Spread of misinformation 	<ul style="list-style-type: none"> - Promotion of testing of patients, family members, and contacts - Dissemination of high-quality, streamlined information and guidance
Overall clinical management 	<ul style="list-style-type: none"> - Facility providers and community volunteers tend to patients and potentially affected contacts 	<ul style="list-style-type: none"> - Low rates of self-testing in part due to laypeople needing to report results centrally - No unified system for hospital admissions or treatment protocols - Sample collection methods and workflow need improvement 	<ul style="list-style-type: none"> - Platform for easy reporting of Ag RDT self-testing results - QR code usage to verify samples between point of collection and lab testing - Mobile operations management platform for sample collection centers
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Inputting information through Microsoft Excel 	<ul style="list-style-type: none"> - High volume of testing and granular patient information make paper-based forms difficult - Higher volumes at public vs. private facilities - Difficult to bulk upload completed Excel data forms - No single mechanism for data flow between facilities 	<ul style="list-style-type: none"> - Digitization of data collection at initial point of contact with patient - Connection of patient information through national ID when being tested multiple times
Capacity-strengthening 	<ul style="list-style-type: none"> - Central portal with training materials and guidance 	<ul style="list-style-type: none"> - HCWs struggle to keep up with changing guidance - Lacking demonstrations or trainings for new guidance - Periodic reorientation to testing strategies 	<ul style="list-style-type: none"> - Centralized software that pushes out guidance updates and revisions to HCWs to encourage compliance - Digitization of information so it can be automatically updated and disseminated
Supply chain support 	—	<ul style="list-style-type: none"> - Demand forecasting based on use rates not used 	<ul style="list-style-type: none"> - Inventory management system for collection centers, which can automatically track use for state-level procurement
Digital ecosystem	<ul style="list-style-type: none"> - Robust ICMR portal for centralized data management and reporting 	<ul style="list-style-type: none"> - Many facilities do not have access to a tablet to complete data entry 	—



India: Key takeaways

The current status is

- Ag RDT capacity has rapidly expanded during India's 2nd Wave
- A centralized reporting database (ICMR) exists, but lengthy data entry processes hold up large volumes at testing locations

A new digital tool should

- Be adaptable to varying volume of testing at different facilities
- Interface with existing centralized data reporting portal
- Allow HCWs to efficiently receive guidance and training updates

Digital tool developers should consider

- The effect large volumes of testing will have on the flexible development of a digital tool
- How to leverage centralized reporting and guidance portal to efficiently push out necessary information to HCWs

Senegal: What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital solution
Referral support 	<ul style="list-style-type: none"> - Patients who present at private facilities are referred to or have samples sent to public facilities to ensure technicians have proper training in Ag RDTs and PCR tests 	—	<ul style="list-style-type: none"> - System to coordinate optimal transport of samples across long distances (up to 114 km)
Patient management 	<ul style="list-style-type: none"> - Initiating symptom treatment while results are pending - Confirmatory PCR testing, regardless of Ag RDT result, ensures fast and improved care of patients 	<ul style="list-style-type: none"> - Communicating results to patients who do not have cell phones 	<ul style="list-style-type: none"> - Digital hub where patients can return to a clinic or any computer to view results, regardless of whether they have a cell phone
Overall clinical management 	<ul style="list-style-type: none"> - Notification sheets of negative results shared with attending physician, chief physician, medical region lead, and MOH - HCWs use WhatsApp to seek advice 	<ul style="list-style-type: none"> - HCW concerns around Ag RDT test performance due to lack of trust in results 	—
Digital record keeping, reporting, surveillance 	—	<ul style="list-style-type: none"> - Time required to transfer data from paper to Excel makes it difficult to generate real-time reports - Missing data can make it difficult to conduct patient follow-up 	<ul style="list-style-type: none"> - Central database for all forms to be used for generating useful reports
Capacity-strengthening 	—	<ul style="list-style-type: none"> - Private facilities cannot conduct Ag RDT or PCR testing due to lack of training and infrastructure 	—
Supply chain support 	<ul style="list-style-type: none"> - National Pharmacy allocates stock of Ag RDTs to medical regions, which allocate to facilities - Ag RDT allocation based on notification reports about daily Ag RDT use in different regions 	<ul style="list-style-type: none"> - Facilities do not have control over supply stock 	<ul style="list-style-type: none"> - Connection between facilities and district level for inventory management
Digital ecosystem	<ul style="list-style-type: none"> - DHIS2 for tracking patient information, sampling date, results, and contact tracing - Sharing reports via email in Excel sheets to inform stock allocation 	<ul style="list-style-type: none"> - Internet connectivity and infrastructure challenges 	—



Senegal: Key takeaways

The current status is

- MOH has strict guidelines to use Ag RDTs in public facilities only due to specified training and infrastructure requirements
- Data reporting and contact tracing are conducted through a centralized system, District Health Information System 2 (DHIS2)

A new digital tool should

- Provide data link between Ag RDT test results and confirmatory PCR testing
- Directly connect with DHIS2
- Standardize data collection and reporting forms

Digital tool developers should consider

- How to connect data collection between public and private facilities
- What kind of content would improve HCW confidence in Ag RDT test methods and results



Vietnam: What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital tool
Referral support 	<ul style="list-style-type: none"> - Viettel software for sample management and transfer between departments 	<ul style="list-style-type: none"> - Results sheets not provided for patients for potential referral - Lacking sample transfer mechanism 	<ul style="list-style-type: none"> - System to coordinate samples transport (as opposed to personal vehicles/public transportation)
Patient management 	—	<ul style="list-style-type: none"> - Difficult to maintain social distancing at community screening sites during COVID-19 outbreaks - Negative results not delivered to patients 	<ul style="list-style-type: none"> - Provide patients with information on COVID-19 and next step - Mental health support for those in need - Facilitation of contact tracing - Artificial intelligence or chat bot to connect with online clinical support
Overall clinical management 	<ul style="list-style-type: none"> - Use of Ag RDT to screen in remote environments 	<ul style="list-style-type: none"> - Different departments/organizations have different data management systems (e.g., epidemiology department vs. testing department) - Concern about Ag RDT performance but unable to confirm with PCR 	<ul style="list-style-type: none"> - Operation system to ensure all patients are admitted and receive timely medical care - Management of at-home self-test results (e.g., use decision logic to provide consultation to people) - Unique patient identification
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Excel is easy to use and adapt to different needs 	<ul style="list-style-type: none"> - Time to collect or transfer data - Incomplete data capture especially in outbreak settings - Complicated administrative procedures and forms preparation associated with reporting - Quality checks are difficult to implement due to lack of standardization 	<ul style="list-style-type: none"> - Ability to evaluate effectiveness of new software - Semi-automation of administrative processes - Centralized data management outside of province level - Disseminating detailed regulations and requirements for software systems
Capacity-strengthening 	<ul style="list-style-type: none"> - Use of group chats to seek guidance and advice from other HCWs 	<ul style="list-style-type: none"> - Limited time available for health professionals - Lack of time for training HCWs on new tools 	<ul style="list-style-type: none"> - Disseminate best practices for HCWs conducting Ag RDTs - Support in-person training with digital learning modules - Moderated forum for HCWs to asynchronously support one another
Supply chain support 	<ul style="list-style-type: none"> - For each health facility, technical departments propose a list of test kits and consumables; financial departments will arrange bidding and procurement of the necessary commodities 	<ul style="list-style-type: none"> - Supply estimation difficult due to rapidly changing situation - Pricing fluctuations make it difficult to secure necessary funding - Mandated bidding process is not amenable to emergency situations 	<ul style="list-style-type: none"> - Real-time supply and inventory management systems receiving data at facility level
Digital ecosystem	<ul style="list-style-type: none"> - Plans to develop overall health information management system 	<ul style="list-style-type: none"> - Investment in infrastructure required to use many existing digital solutions (i.e., internet connection) - Need to pay extra cost to add on COVID-19-specific management modules to existing digital tools - Many regions do not have internet/3G or 4G 	<ul style="list-style-type: none"> - Improve interoperability between existing information systems

Vietnam: Key takeaways

The current status is

- Ag RDT capacity has expanded rapidly in response to major outbreaks across the country
- Disjointed data management systems between lab and health care facilities

A new digital tool should

- Be amenable to fluctuations in testing volume with a focus on outbreak management
- Allow for data input from various sources for higher-level reporting
- Be developed for use in a no- to low-network connectivity environment

Digital tool developers should consider

- Potential areas for automation, especially for use in high-volume testing areas
- Lack of widespread digital infrastructure

Zambia: What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital tool
Referral support 	<ul style="list-style-type: none"> - HCWs follow up with patients who test positive either by phone or physically at the address they provided 	<ul style="list-style-type: none"> - Missing or incorrect patient information (e.g., names, addresses) 	<ul style="list-style-type: none"> - Data verification features for data entry - Creating linkages between lab, surveillance, and clinical teams to share data
Patient management 	<ul style="list-style-type: none"> - HCWs and surveillance team members reach patients either by phone or physically at the address they provided 	<ul style="list-style-type: none"> - Inconsistent communication of results, especially for negative cases 	<ul style="list-style-type: none"> - Inform patients of test result through mobile app
Overall clinical management 	<ul style="list-style-type: none"> - Contact tracing initiated by surveillance team upon positive test result 	<ul style="list-style-type: none"> - Misapplication of Ag RDT due to shorter turnaround time 	<ul style="list-style-type: none"> - System focused on clerk or data personnel at sample-collection site to streamline data capture
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Multiple data collection tools and management systems 	<ul style="list-style-type: none"> - Incomplete information during data capture - Inadequacies in negative result data reporting - Data transcription errors - Underreporting especially due to digital infrastructure issues - Variation across sites of data being captured 	<ul style="list-style-type: none"> - Mobile data collection tool focused on reducing transcription errors - Require some minimum amount of data to improve data quality - Provision for laypeople to input information into surveillance tool
Capacity-strengthening 	<ul style="list-style-type: none"> - Competency assessments for HCWs 	<ul style="list-style-type: none"> - Poor adherence to guidelines - High turnover of staff trained to conduct COVID-19 test often due to career advancement - HCWs must take work home with them to ensure reporting 	<ul style="list-style-type: none"> - Digitize and disseminate notifications and guidelines to HCWs
Supply chain support 	<ul style="list-style-type: none"> - MOH and Zambia Medicines and Medical Supply Agency (ZAMMSA) work well together 	<ul style="list-style-type: none"> - Multiple channels of procurement for different supplies 	<ul style="list-style-type: none"> - Semi-automated inventory management to directly report usage to ZAMMSA
Digital ecosystem	<ul style="list-style-type: none"> - Effective access control for confidential health and testing data - Connectivity support to DisaLab 	<ul style="list-style-type: none"> - Blackouts and connectivity/internet challenges - Lack of computers and related infrastructure - Data security issues 	<ul style="list-style-type: none"> - APIs to integrate existing information systems - Build upon existing HIV notification program to inform patients and caregivers of test result



Zambia: Key takeaways

The current status is

- Ag RDTs are available, but due to fluctuating supply, guidance is changing for testing requirements
- Hub and spoke model of data reporting through labs (DisaLab system)

A new digital tool should

- Facilitate data completeness for returning and reporting results
- Interface with or build upon existing digital data collection tools in use
- Provide data linkage between sample collection sites and labs

Digital tool developers should consider

- What types of mobile functionalities would be appropriate for use in both facility and community-based interaction
- Methods to minimize transcription errors and time to collect data

Potential opportunities for addressing challenges across geographies

In scope vs out of scope for digital solution ✓ In scope ✗ Out of scope

	Referral support	Patient management	Clinical management	Digital record keeping, reporting, surveillance	Capacity-strengthening	Supply chain support
Patient level	<ul style="list-style-type: none"> ✓ Viewing referrals in centralized mobile platform ✓ Referral reminders 	<ul style="list-style-type: none"> ✓ Centralized returning of results ✓ Two-way communication with provider 	<ul style="list-style-type: none"> ✓ Ag RDT self-test results reporting ✓ Chat bot for COVID-19 questions and concerns 	<ul style="list-style-type: none"> ✓ Storing all data associated with patient's COVID-19 management 	NA	NA
Provider level	<ul style="list-style-type: none"> ✓ Referral platform ✓ Ability to share patient information to facilities ✓ Follow-up on incomplete referrals 	<ul style="list-style-type: none"> ✓ Two-way communication with patient ✓ Patient dashboard 	<ul style="list-style-type: none"> ✓ Mobile platform for providers to connect ✓ Contact tracing platform linked to patient data ✓ Running Ag RDT 	<ul style="list-style-type: none"> ✓ Mobile data capture tool at point of care ✓ Access to stored patient records 	<ul style="list-style-type: none"> ✗ Training ✓ Automated updates and reminders for new guidance or training material 	<ul style="list-style-type: none"> ✓ Standardized inventory forms sent to district level ✓ Semi-automated inventory reporting
District level	<ul style="list-style-type: none"> ✗ Identifying and locating nearby health facilities 	<ul style="list-style-type: none"> ✓ Mass communication of accurate COVID-19 testing information 	<ul style="list-style-type: none"> ✓ Patient data linked to contact tracing ✗ Sample collection coordination 	<ul style="list-style-type: none"> ✓ Automatic reporting of point of care data ✓ Linking patient data across facilities 	<ul style="list-style-type: none"> ✗ Facilitation of in-person training and workshops 	<ul style="list-style-type: none"> ✓ Inventory management ✓ Support in prevention of stockout and ordering
Country level	<ul style="list-style-type: none"> ✗ Health facility registry for referrals 	NA	<ul style="list-style-type: none"> ✓ Results and follow-up procedure recorded for country-level analysis 	<ul style="list-style-type: none"> ✓ Aggregation of point of care data to high-level dashboards ✗ Ability to connect distinct information systems 	<ul style="list-style-type: none"> ✗ Centralized online portal for all guidance and training 	<ul style="list-style-type: none"> ✓ Demand planning based on aggregated Ag RDT utilization and results data

Potential opportunities for addressing challenges across geographies

Feasibility of digital solution to support current Ag RDT rollout:

- High
- Medium
- Low

	Referral support	Patient management	Clinical management	Digital record keeping, reporting, surveillance	Capacity-strengthening	Supply chain support
Patient level	<ul style="list-style-type: none"> ✓ Viewing referrals in centralized mobile platform ✓ Referral reminders 	<ul style="list-style-type: none"> ✓ Centralized returning of results ✓ Two-way communication with provider 	<ul style="list-style-type: none"> ✓ Ag RDT self-test results reporting ✓ Chat bot for COVID-19 questions and concerns 	<ul style="list-style-type: none"> ✓ Storing all data associated with patient's COVID-19 management 	NA	NA
Provider level	<ul style="list-style-type: none"> ✓ Referral platform ✓ Ability to share patient information to facilities ✓ Follow-up on incomplete referrals 	<ul style="list-style-type: none"> ✓ Two-way communication with patient ✓ Patient dashboard 	<ul style="list-style-type: none"> ✓ Mobile platform for providers to connect ✓ Contact tracing platform linked to patient data ✓ Running Ag RDT 	<ul style="list-style-type: none"> ✓ Mobile data capture tool at point of care ✓ Access to stored patient records 	<ul style="list-style-type: none"> × Training ✓ Automated updated and reminders for new guidance or training material 	<ul style="list-style-type: none"> ✓ Standardized inventory forms sent to district level ✓ Semi-automated inventory reporting
District level	<ul style="list-style-type: none"> × Identifying and locating nearby health facilities 	<ul style="list-style-type: none"> - Mass communication of accurate COVID-19 testing information 	<ul style="list-style-type: none"> ✓ Patient data linked to contact tracing × Sample collection coordination 	<ul style="list-style-type: none"> ✓ Automatic reporting of point of care data ✓ Linking patient data across facilities 	<ul style="list-style-type: none"> × Facilitation of in-person training and workshops 	<ul style="list-style-type: none"> ✓ Inventory management ✓ Support in prevention of stockout and ordering
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Patient level should be explored after provider level

Digital record keeping, reporting, surveillance

Need for training needs to be validated at provider-level

Greatest unmet need at current Ag RDT rollout phase will take place at the provider-level

High potential for digital solution to mitigate record keeping, reporting, and surveillance challenges

Country-level should be explored after provider-level

Referral environment is currently limited by lack of facility registration data

Key takeaways

Given on this initial understanding of the Ag RDT environment, the following should be prioritized for the development of a digital solution:

- Based on the current phase of Ag RDT rollout, across geographies, **providers** have the highest burden and could benefit most from a streamlined, efficient digital solution
- **Digital record keeping, reporting, and surveillance** is an area where a digital solution could serve to connect providers to multiple areas of the health system

Next, based on **feedback from important stakeholders**, including users, FIND colleagues, potential vendors, and relevant external stakeholders in the Ag RDT space, a list of **narrowed down** and **specific functionalities** will be developed for a digital solution.

Limitations

- Small sample size of 24 stakeholders
- Highly evolving COVID-19 context
- Did not speak directly with healthcare providers or patients as part of this process

Next steps

- Disseminating information with key stakeholders to receive **input and validation** for proposed prioritization
- Discussing opportunities to address key challenges with **global mHealth vendors**
- Developing digital solution using **human-centered design** principles
- Implementation and **testing of digital solution** in one to two geographies

Abbreviations

Ag	antigen	PCR	polymerase chain reaction
API	application programming interface	POC	point of care
COVID-19	coronavirus disease 2019	Q	quarter (e.g., Q1=quarter 1)
DHIS2	District Health Information Software 2	rt-PCR	reverse transcription polymerase chain reaction
HCW	health care worker	RDT	rapid diagnostic test
ICU	intensive care unit	SMS	short message service
ID	identification code or number	WHO	World Health Organization
MOH	Ministry of Health		

- 1 Overview of the assessment
- 2 Summary and key themes
- 3 Country-specific findings**

Interview guide

Interview questions related to the following **themes**:



Status of COVID-19 diagnostic testing



Patient testing process



Provider procedure and training



Data reporting



Supply chains

Interview guide

The following **expanded use cases** for COVID-19 Ag RDT data capture solutions were explored during stakeholder interviews:



Country-specific findings

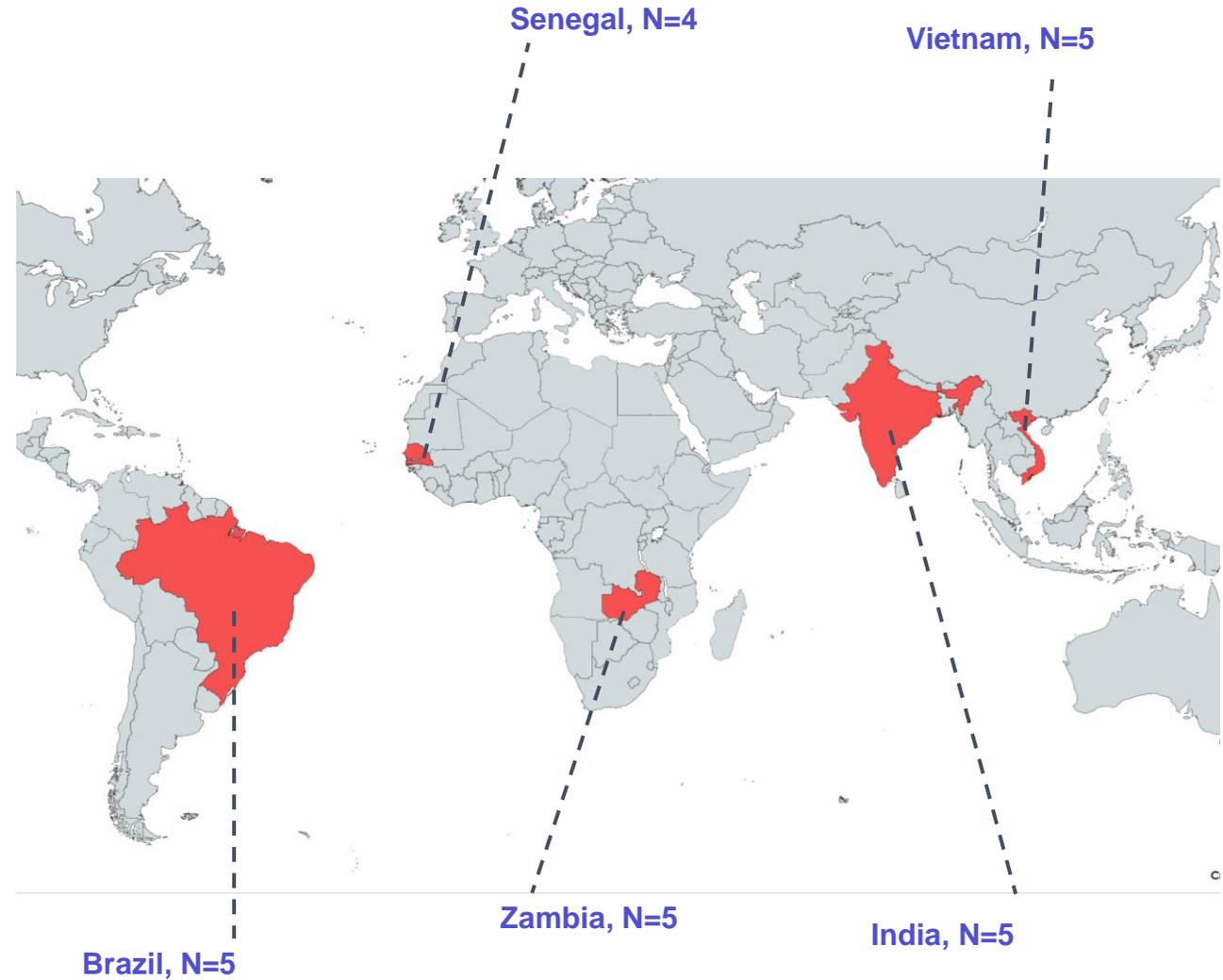
Brazil

India

Senegal

Vietnam

Zambia





Details of interviews conducted in Brazil

List of abbreviations used in this section:

CPF: National Person ID Number

e-SUS: electronic Unified Health System

GAL: Laboratory Environment Management System

LACENs: Central Laboratories of Public Health

PAHO: Pan American Health Organization

SIVEP: Epidemiological Surveillance Information System

UPA: Emergency care unit

Please note the following factors of interviews conducted in Brazil:

- Some interviewees (2 of 5) provided robust information specific to their local/regional contexts and, as such, their information/perceptions are not necessarily applicable to the broader national context—these points have been called out as state-level observations.
- Interviews were conducted by and analyzed in collaboration with partners at Global Health Strategies in Rio de Janeiro.



Global Health Strategies

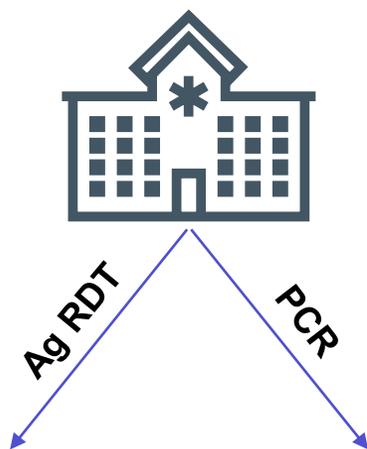


Status of COVID-19 diagnostic testing



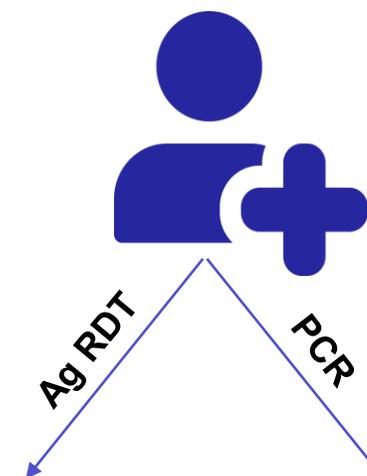
Since the onset of the pandemic, **testing capacity has advanced rapidly in Brazil**. Deployment of Ag RDTs marked an important advancement in improving capacity and detection of cases in early 2021, with support from PAHO.

Where does testing occur?



Municipalities adapt central COVID-19 guidance slightly to **local needs and supply availability**

Who gets tested?



- Primary health units
- Emergency health units
- Public and private hospitals
- Drugstores within private health care system

- Central Laboratories of Public Health (LACENs)
- Biochemistry labs at public and private hospitals
- Private lab system

- **Symptomatic** patients within 5-7 days of symptom onset only
- Prioritization of **severe** cases, patients with comorbidities, and contact tracing
- No asymptomatic patients at risk of false negative **unless identified via contact tracing**

- Symptomatic patients
- Asymptomatic patients

No self-testing is being conducted in Brazil at this time

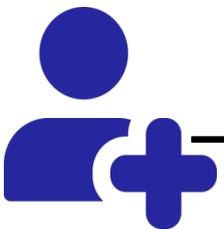
"The main challenge is related to the general population's understanding of what the appropriate moment and type of test for each case is. When the patient presents for testing, even if they are asymptomatic, it is hard for the professional to refuse testing. It is a challenge to have a population that is already mentally vulnerable in various forms to understand this."



Patient testing process



Patient presents at public or private facility for testing



PCR test samples sent to health unit with testing capabilities

Ag RDT performed on-site

Patient receives results

Patient recommended to isolate at home until results communicated within 48-72 hours

Results reported by telephone, WhatsApp, email, or patient/family member picking up a report at the health unit (varies by municipality/team)

Results available in 15 minutes at the point of care

Clinical management in the event of a positive result

- If Ag RDT only, **PCR conducted to confirm** quarantine, isolation, or medication
- Immediate referral based on clinical status
- The patient is **isolated** and informed that contacts should also be tested, usually with Ag RDT
- Surveillance is contacted for **contact tracing**
- Contacts are listed in municipal platform and patient sent home to self-isolate though self-isolation is **not always feasible**



These steps **do not apply to drugstore** Ag-RDT testing in the **private sector** where, though it is mandated, reporting of results into surveillance systems is not always followed, and no monitoring of or following up with patients is conducted

"The biggest challenge for health professionals is to monitor contacts, as people who live with positive patients still have to go to work and usually can't self-isolate. Many health units have separate tents to screen suspected and confirmed COVID-19 patients."

"The main challenge is for the patient information to be available for surveillance to track contacts. It would be good if systems were integrated."



Provider procedure and training



Facility and testing environment

- Initial data collection occurs on paper-based form
- Majority of clinics have **internet access**, though more limited in rural settings, for which paper reporting is key

Tracking different tests:

- For Ag RDT, patient's initials are written on device
- For PCR, non-standard label with patient's initials and reference number

Trainings and support

- MOH provides training to **State Surveillance and Laboratory units** which are in turn responsible for training all other HCWs
- Since training and testing coordination is provided at the state level, **fragmentation** exists around type of training provided at the facility level
- Training materials developed for quality assurance (created by PAHO) and state-level units are used
- **Informal training channels** exist between state-level units. One State Surveillance organization developed a video, which ended up being so helpful, it was circulated to multiple units
- Drugstore and laboratory staff **lacking adequate training**

Data collection form 	Name of health unit	<i>Often already specified in system</i>
	National person ID number (CPF)	
	Date of birth	
	Mother's name	
	Demographic data	<i>If not already on the patient's registry on the primary health care unit</i>
	Comorbidities and symptoms	
	Testing data and results	

"The video helped a lot. It has been successfully used, thus, demystifying training and sample collection for testing. There is now an understanding that there is no more need for in-person training led by highly qualified health professionals, and it has become clear that the sample collection can even be performed by the patient [in the case of nasal swab]."

"It is consensus that the appropriate amount of information for COVID reporting should be the minimum, as a large form would not be compatible with the volume of data to be reported"



Existing systems

Ag RDT data are first recorded on paper or spreadsheets and then **separately** reported through 3 different systems:

“This triple data entry poses a challenge to knowing where antigen test data lies.”



PCR results are entered into 1 system:



Patients can access 1 system:



A platform exclusive to municipality health units

- States and municipalities have developed a **level of autonomy** from the MOH regarding information systems
- **Does not integrate** with other systems

e-SUS AB

Primary health care data system

- Registration into this platform is made per primary health care units
- Data within system managed by municipality health department, but broader **database managed by MOH**

e-SUS Notifica

Federal system for reporting cases

- **Any health professional** can report through this platform, including the private sector
- Data on mild symptoms is **exported and managed** by the municipality's surveillance area
- Many COVID-19 cases initially are put into SIVEP, which is for severe acute respiratory infections
- Recent launch of monitoring module but no centralization efforts yet

GAL

Laboratory environment manager

- Molecular PCR results are input into this platform
- There is no space for reporting of Ag RDT results in this platform
- **No link** exists between Ag RDT and PCR data

Conecte SUS

Patient-facing portal

- Allows citizens to view clinical history through mobile device or web browser
- **Integrated with e-SUS Notifica**, from which data is automatically transferred
- **Not linked** to private healthcare system
- Is helpful for vaccine tracking and test result reporting, but not contact tracing

These 4 systems are **robust** at a national level but **lack flexibility** which makes contact tracing difficult



Data reporting



Uses for reported data

- **OpenData SUS** contains data for MOH including confirmation of case, state, epidemiological, and demographic data from e-SUS Notifica
- TabNet tool within OpenData SUS **updated daily** with aggregated data made available by MOH
- MOH makes data available to municipalities, restricted to **in-house servers**
- Municipality's Institute of Informatics works with servers and has data center to make data from OpenData SUS available to public
- Municipality has a **COVID-19 data dashboard** automated for use by the press and health managers

"It is hard work and time consuming to report several times on several different platforms."

"A tool that could integrate the databases used by health professionals would be very useful."

Redundancies and inefficiencies

- Systems are **not integrated**, causing duplicative entry
- **Transcription of data** from paper to electronic systems is a key challenge, particularly when COVID-19 case volume is high
- There are many local nuances because municipalities are using a **wide variety of tools** and each state has their own approach for reporting results into required systems
- At emergency care units (UPAs) data is reported on paper only, and pharmacies do not report at all, causing **underreporting**
- Unequal access to technologies with **significant local and regional inequities**

"The biggest challenge is to maintain the quality of the database, as, for this, it has to be done for several other databases."



Supply chain



Supporting organizations



- In early 2021, **PAHO** donated many Ag RDTs to Brazil
- At the state level, there may be health surveillance foundations to lead procurement process

Procurement systems



- **MOH** manages procurement at the central level
- **States** have a strategic input system to qualify usage of medication, tests, and other supplies
- Each **municipality** also has their own supply management systems within the health units and must report to the state to receive supplies. This is managed by the Sub-Secretariat
- Emergency procurements and biddings also exist

Supply security issues



- Appropriate use and stock control
- Distribution and allocation of resources appropriately to **avoid waste**
- Managing distribution to health units with **low volumes of patients**

"[Tracking supplies for COVID-19 testing] is managed through the central system that also distributes it to the health units. The health units must report their needs/consumption to receive more batches."



What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital solution
Referral support 	<ul style="list-style-type: none"> - Referral (often through WhatsApp) of patients with positive results 	<ul style="list-style-type: none"> - Currently no digital platform for referral support 	<ul style="list-style-type: none"> - Municipal-level referral system integrated with Conecte SUS
Patient management 	<ul style="list-style-type: none"> - Using WhatsApp, telephone, and Conecte SUS to contact patients - Immediate reporting of Ag RDT results to patient at POC 	<ul style="list-style-type: none"> - Misinformation on COVID-19 testing and treatment (e.g., early use of serological tests) - Poor monitoring of contacts and compliance with self-isolation 	<ul style="list-style-type: none"> - Support contact tracing and monitoring of patients and close contacts - Communication to general public about testing - Integration with Conecte SUS
Overall clinical management 	<ul style="list-style-type: none"> - Various levels of care available to citizens 	<ul style="list-style-type: none"> - General population lack awareness regarding when to get tested - Multiple tests conducted for the same infection may be reported as new cases 	<ul style="list-style-type: none"> - Integration of data collected from Ag RDT and PCR testing across municipalities - Focus on primary care setting
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Healthcare workers (HCWs) can enter data into various systems to be aggregated 	<ul style="list-style-type: none"> - Use of paper systems at local level - Underreporting of cases - Parallel reporting, and non-standardized municipal systems - Variable reporting rates depending on the level of the health care professional - Incomplete information 	<ul style="list-style-type: none"> - Engaging with states and municipalities as it would be more difficult to harmonize a single information system at the national level - Integration of systems/databases - Asynchronous data capture for offline environments
Capacity-strengthening 	<ul style="list-style-type: none"> - In general, Ag RDT use is being implemented as per WHO guidelines 	<ul style="list-style-type: none"> - Limited time available for health professionals - Some HCW compliance challenges with testing guideline adherence 	<ul style="list-style-type: none"> - Support HCWs in best practices for conduct of Ag RDTs - Provide HCWs with real-time updates and reminders - Wider dissemination of remote/virtual trainings, building on local successes
Supply chain support 	<ul style="list-style-type: none"> - Centralized system for procurement of supplies 	<ul style="list-style-type: none"> - Appropriate use and stock control - Waste mitigation and accurate ordering 	<ul style="list-style-type: none"> - Municipality- and state-level reporting of supplies - Semi-automated inventory management at the facility level
Digital ecosystem	<ul style="list-style-type: none"> - General population own and use mobile technologies - Multiple data reporting systems exist - Cloud services for internal information exchange (Microsoft Teams, OneDrive) 	<ul style="list-style-type: none"> - Lack of resources for data analysis - Existing information systems not interoperable - Information systems have been adapted to fit local context hindering data sharing 	<ul style="list-style-type: none"> - Ability to connect disparate systems, such as Ag RDT and PCR results databases

Country-specific findings

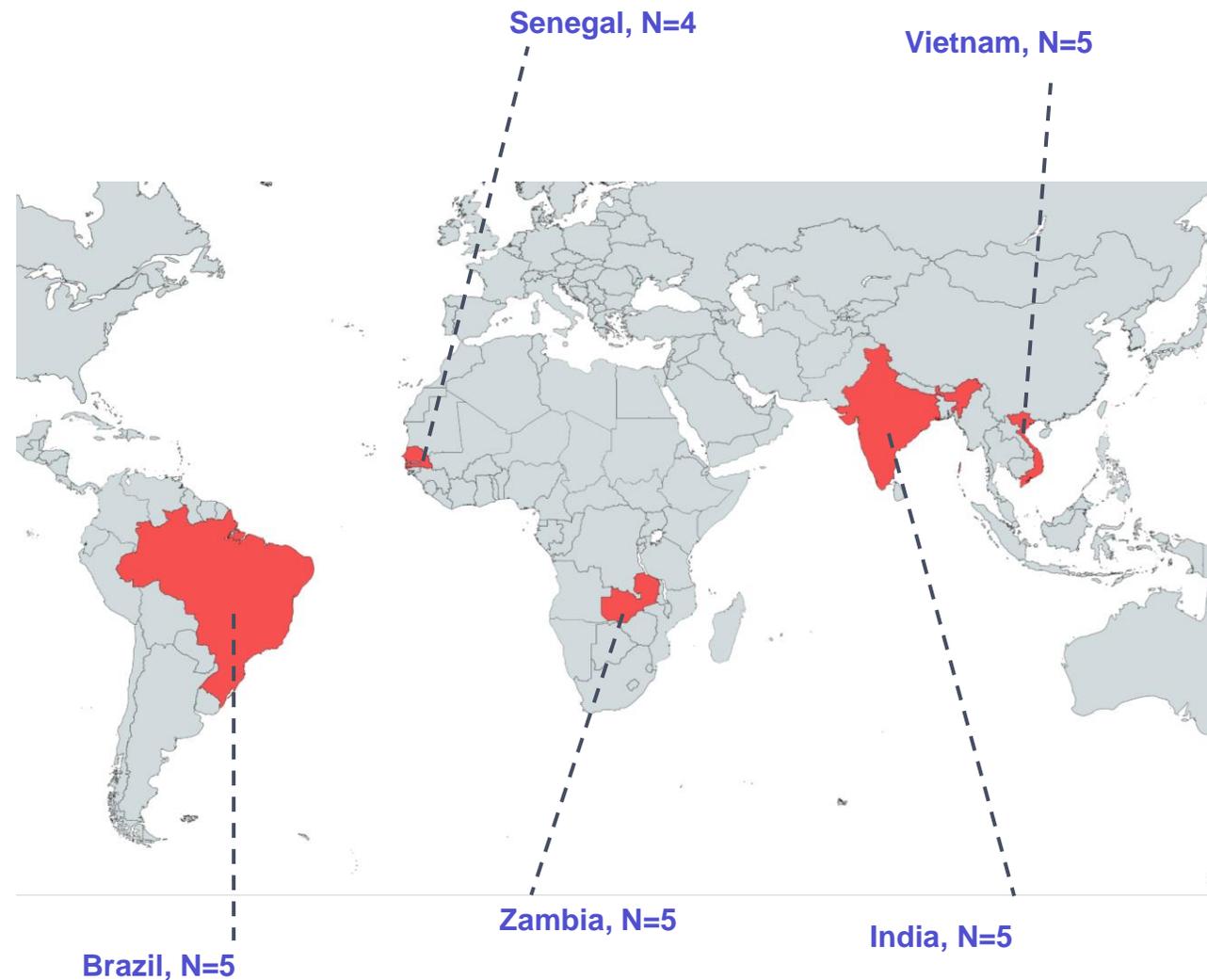
Brazil

India

Senegal

Vietnam

Zambia





Details of interviews conducted in India

List of abbreviations used in this section:

HMIS: Health management information system

ICMR: Indian Council of Medical Research (within Department of Health Research, Ministry of Health and Family Welfare, Government of India)

iGOT: Integrated Government Online Training

MOHFW: Ministry of Health and Family Welfare

SRF: Sample registration form

Please note the following factors of interviews conducted in India:

- The 5 stakeholder interviews in India were conducted in July and August 2021
- Ag RDT implementation rapidly expanded during the 2nd Wave



Status of COVID-19 diagnostic testing



During the 1st Wave, testing was dependent on rt-PCR due to inadequate Ag RDT performance. When the 2nd Wave occurred, Ag RDT capacity rapidly expanded with high-quality Ag RDTs.

Where does testing occur?



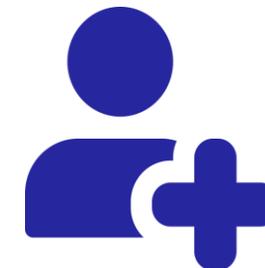
Ag RDT

rt-PCR



Central portal for updated guidelines exists but it is still difficult for users to keep up to date with new or changing guidelines

Who gets tested?



Ag RDT

rt-PCR

“Digital solution can help – potentially [as] a software at central level that can push to mobiles of doctors and give overview of revisions and encourage to follow them.”

Mass testing

- Testing centers
- Sample collection centers within health system
- Public and community health centers

Targeted testing

- District hospitals
- COVID-19 care centers for high-risk or symptomatic patients

- District hospitals (accumulate samples from public and community health centers)
- National laboratories
- COVID-19 care centers for high-risk or symptomatic patients

- Anyone who walks into testing center should first be screened with Ag RDT
- Random testing at municipal corporation buildings with high traffic (e.g., bus, train station)

- Travelers
- Follow-up for asymptomatic Ag RDT positives

“WHO set minimum standards of how many should be testing per million population but in India it is hard to test ~300,000 [people per million people]”

Self-testing with COVID-19 Ag RDT kits has begun, but there is hesitance, and few are proactively buying kits



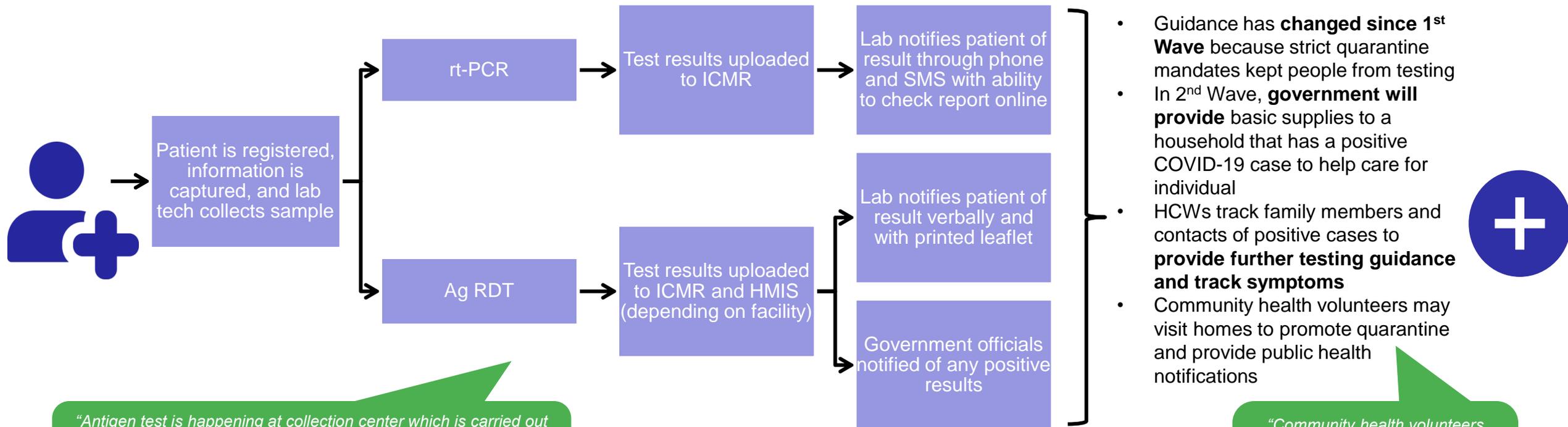
Patient testing process



Patient presents for testing at sample collection center

Patient receives results whether positive or negative

Clinical management in the event of a positive result



"Antigen test is happening at collection center which is carried out now in most of the states, test results uploaded by collection center to the ICMR portal. Whatever report result comes out, lab notifies the patient of test result"

"When Antigen test result is positive, we load the result on our HMIS system as well as the ICMR website. This is usually done within the first half an hour of the result. We upload the negative antigen report in the system [later] as well."

"Community health volunteers may sanitize building premises and put a notification up in building that this building has COVID-19 cases."

- Guidance has **changed since 1st Wave** because strict quarantine mandates kept people from testing
- In 2nd Wave, **government will provide** basic supplies to a household that has a positive COVID-19 case to help care for individual
- HCWs track family members and contacts of positive cases to **provide further testing guidance and track symptoms**
- Community health volunteers may visit homes to promote quarantine and provide public health notifications





Provider procedure and training



Facility and testing environment

- At collection site, patient information is collected on paper and copied onto sample tube. This information is then **manually transferred into ICMR** portal to automatically create and assign a SRF ID to each sample
- Each lab has a **different login for access to ICMR platform** with varying permissions based on operator access level. Specific details such as operator ID and kit type must be entered.
- Many collection centers **do not have access** to a tablet

Trainings and support

- **MOHFW central portal** has specific section for guidance, documents and webinars for training, and Integrated Government Online Training (iGOT) modules
- HCWs check MOHFW central portal for updated guidelines but **struggle to keep up with changes** (e.g., some HCWs in the field are using 3-month-old guidelines)
- Staff could benefit from additional demonstrations and trainings around new guidelines

Data collection form



Unique SRF ID created for each sample

Name

National ID number

Address

Symptoms

Vaccination status

Reason for testing

Known COVID-19 positive contacts

"In places where information isn't clearly written, when lab staff compares against the line list and can't make out what is written, they have to discard the samples."

"Jalgaon Municipal Corporation testing center in Maharashtra will ask for all information and use antigen testing first, the person is asked to enter name, address, contact, alternative contact number and primary contacts they have been in touch with in an excel sheet. We maintain a physical copy of the details to mitigate any potential system failure."



Existing systems

ICMR Portal

Lab information management system

- Data is collected on either on **paper-based or Excel forms**
- Once patient registration and information gathering is complete, paper-based data is **manually transferred** into ICMR portal by health facility staff
- All lab testing results are reported into ICMR portal
- For collection centers without testing capacity: lab staff set up **WhatsApp groups** to send results and reports

Microsoft Excel

Data collection tool

- **Data collection forms** have been developed to be used in Excel across numerous health facilities
- Excel forms must be manually input into ICMR portal (unless using Cloud Pathology software)

WhatsApp

Lab communication tool

- Labs use a closely monitored WhatsApp group to share **COVID-19 reports and status summaries**
- Collated lists of all test results shared for easier reference and faster sharing

Cloud Pathology software

Private sector labs

- Developed in Maharashtra as a **digital solution** for private sector labs
- District commissioner enquired about how public labs could leverage system for **bulk upload** of rt-PCR Excel data sheets
- System has simplified data entry by connecting patient and test **data flowing from initial point of contact** at collection centers to **result notification** through ICMR portal
- Has been implemented in **Punjab**



Uses for reported data

- Collection center and labs input all data into ICMR portal
- Both **negative and positive results** are recorded
- **Government officials** are notified of positive test results
- MOHFW provides **data to public** through online portal

“The re-verification of samples at lab manually against info given to clear digital format [is] another challenge [that] could be eliminated if you have seamless mechanism for digitizing data at the entry point.”

Redundancies and inefficiencies

- **Duplication of work** due to paper-based data collection and online reporting
- Delays and long wait times at collection centers due to **time required to input data**
- Lab staff must manually **re-verify samples** against information digitally provided by collection center staff
- HCWs **manually** looking up new guidance rolled out by ICMR



Supply chain



Supporting organizations



- ICMR
- UNICEF

“For the Ag RDT kits, our corporation does the procurement at the local level. During the 2nd Wave, the kits were not easily available due to high demand and prices also escalated. The standardization of the kits is important because the performance of each kit varies. We only buy kits that are listed on the ICMR portal.”

Procurement systems



- Procurement processes **differ** between state and municipal corporations
- State-level: each state procures supplies to **meet testing needs** which are supplied to regional warehouses, then to district-level storage, and finally to discrete collection centers.
- Municipal corporation: procure test kits through different mechanism

Supply security issues



- **Stock outs** from collection centers and labs occurred, but frequency of occurrence lessened throughout the 2nd Wave
- No mechanism to **forecast demand** by collection center
- Utilization rates are not considered when allocating supply, instead a **fixed number of Ag RDTs** are provided to each site

What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital solution
Referral support 	<ul style="list-style-type: none"> - Hospital patients with positive Ag RDT immediately taken to intensive care unit (ICU) 	<ul style="list-style-type: none"> - No data link between lab test results and admission to hospital 	—
Patient management 	<ul style="list-style-type: none"> - Positive and negative results available to patients through phone, SMS, and/or online portal 	<ul style="list-style-type: none"> - Informing patients of results can be timelier and more streamlined - Spread of misinformation 	<ul style="list-style-type: none"> - Promotion of testing of patients, family members, and contacts - Dissemination of high-quality, streamlined information and guidance
Overall clinical management 	<ul style="list-style-type: none"> - Facility providers and community volunteers tend to patients and potentially affected contacts 	<ul style="list-style-type: none"> - Low rates of self-testing in part due to laypeople needing to report results centrally - No unified system for hospital admissions or treatment protocols - Sample collection methods and workflow need improvement 	<ul style="list-style-type: none"> - Platform for easy reporting of Ag RDT self-testing results - QR code usage to verify samples between point of collection and lab testing - Mobile operations management platform for sample collection centers
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Inputting information through Microsoft Excel 	<ul style="list-style-type: none"> - High volume of testing and granular patient information make paper-based forms difficult - Higher volumes at public vs. private facilities - Difficult to bulk upload completed Excel data forms - No single mechanism for data flow between facilities 	<ul style="list-style-type: none"> - Digitization of data collection at initial point of contact with patient - Connection of patient information through national ID when being tested multiple times
Capacity-strengthening 	<ul style="list-style-type: none"> - Central portal with training materials and guidance 	<ul style="list-style-type: none"> - HCWs struggle to keep up with changing guidance - Lacking demonstrations or trainings for new guidance - Periodic reorientation to testing strategies 	<ul style="list-style-type: none"> - Centralized software that pushes out guidance updates and revisions to HCWs to encourage compliance - Digitization of information so it can be automatically updated and disseminated
Supply chain support 	—	<ul style="list-style-type: none"> - Demand forecasting based on use rates not used 	<ul style="list-style-type: none"> - Inventory management system for collection centers, which can automatically track use for state-level procurement
Digital ecosystem	<ul style="list-style-type: none"> - Robust ICMR portal for centralized data management and reporting 	<ul style="list-style-type: none"> - Many facilities do not have access to a tablet to complete data entry 	—

Country-specific findings

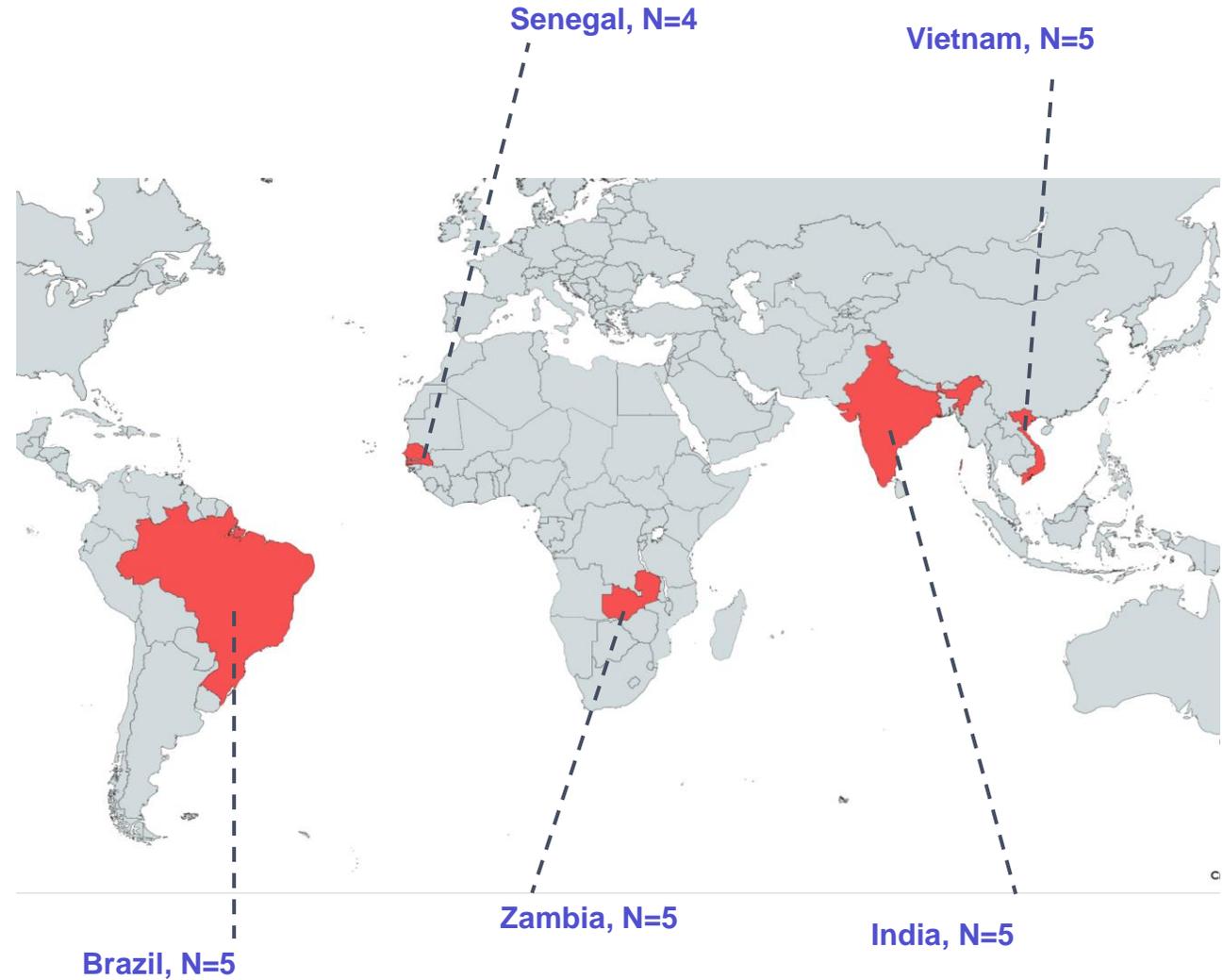
Brazil

India

Senegal

Vietnam

Zambia





Details of interviews conducted in Senegal

List of abbreviations used in this section:

IMF/MFI: Infirmier Médecin Chef [Chief Nurse]

IPD: Institut Pasteur de Dakar

IRESSEF: Institut de Recherche en Sante, de Surveillance Epidémiologique, et de Formation (Institute for Health Research, Epidemiological Surveillance, and Training)

Please note the following factors of interviews conducted in Senegal:

- The 3 stakeholder interviews in Senegal were conducted in June and July 2021; additional interviews were unable to be scheduled due to high stakeholder involvement in and prioritization of the COVID-19 response
- Interviewees included those working at public and private health facilities

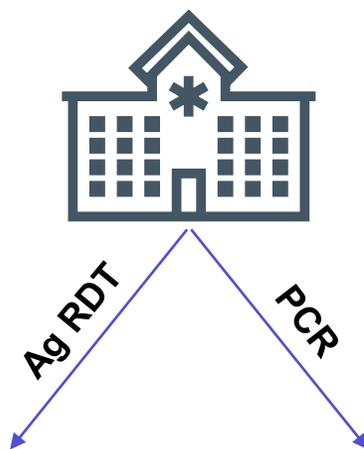


Patient testing process



MOH guidelines only permit Ag RDT and PCR testing at **public health facilities** due to training requirements and lack of infrastructure at private facilities. Private facilities must refer patients to public facilities for Ag RDT or PCR tests.

Where does testing occur?



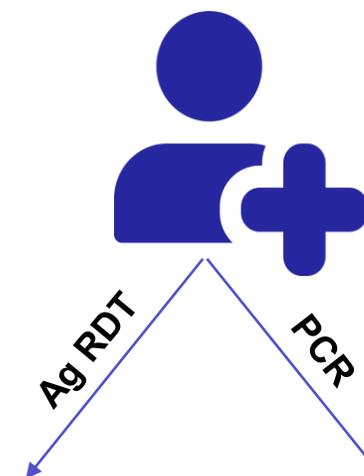
- Border areas
- Hospitals and health facilities
- Public health facilities (**not** in private facilities)
- Point of care settings
- Some occupational settings (i.e., agribusinesses)

- Border areas
- Hospitals and health facilities

★
IPD, a private lab, is an exception to this mandate. At the beginning of the pandemic, all public health districts sent samples to IPD for testing.

“Since it is a border area, at least 400 tests were done. The MoH provided the team with a machine for PCR testing but very difficult compared to the results because the whole region of St Louis was directed to the district of Richard Toll. Fortunately, RDT is available.”

Who gets tested?



- Patients suspected of having COVID-19

- Patients suspected of having COVID-19
- **Confirmation** of Ag RDT tests
- Travelers



Patient's testing process

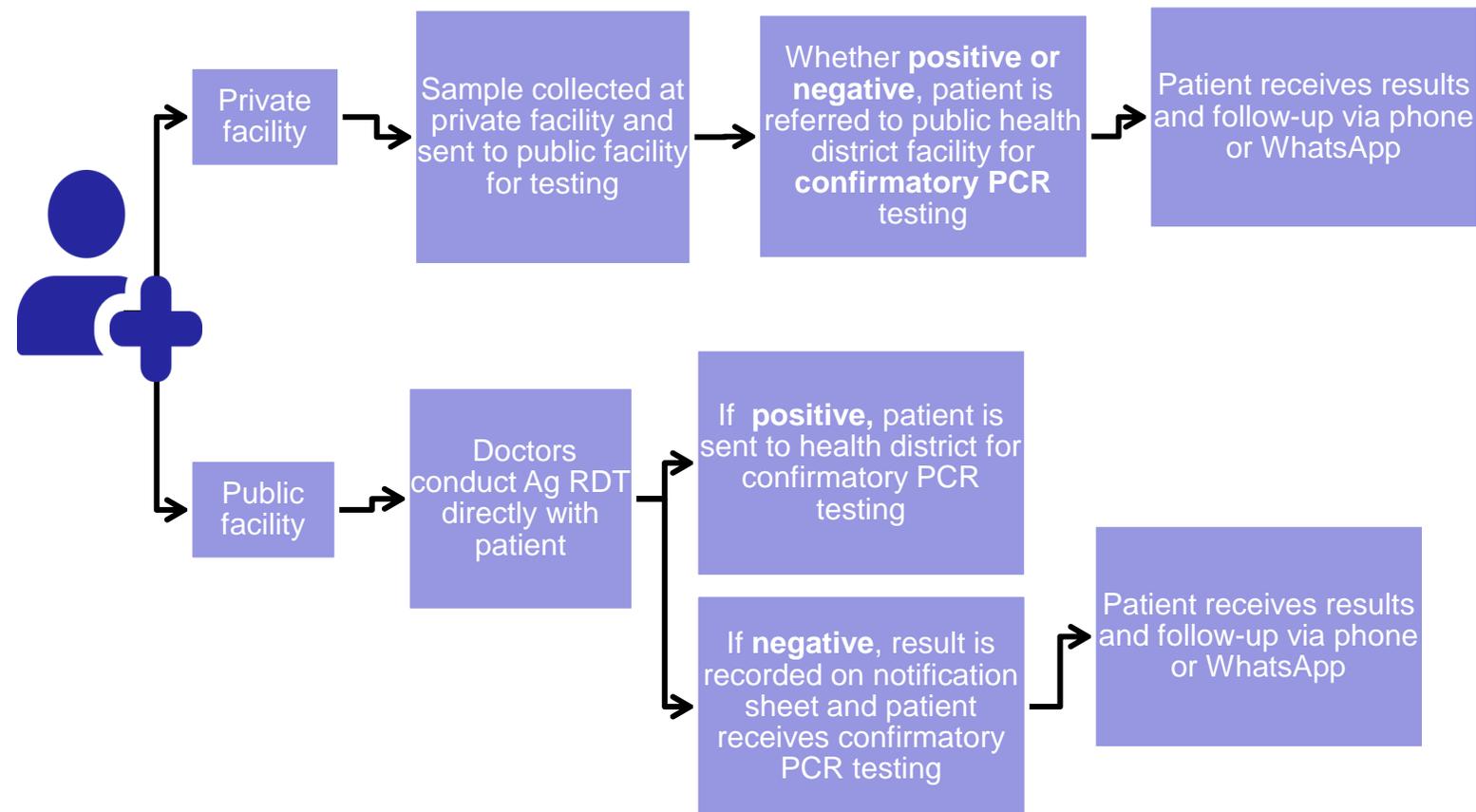


Many health care workers are not confident in the performance on Ag RDTs and often send all patients, regardless of result, for PCR confirmatory testing.

Patient presents for Ag RDT testing

Patient receives Ag RDT and confirmatory PCR results in 3-4 days

Clinical management in the event of a positive result or suspected case



- Hospitalized patients receive results from attending physician
- If results are negative, but patient is hospitalized and has **COVID-19 symptoms**, they will be referred to a specialist
- Patient receives advice based on **MOH guidelines**, such as remaining at home and limiting contact with others. Follow-up is conducted via phone or WhatsApp
- If a **positive patient's symptoms are severe**, and there is space in the health facilities, the patient will be hospitalized



"Before, if it was the doctor who sent the patient, symptomatic treatment is requested while pending the result. Guidance is also provided. And after result, the information is given directly to the person tested, advice is provided, how to behave at home, procedures to follow. It also depends on MoH recommendations/guidelines that change over time."



Provider procedure and training



Facility and testing environment

- At the beginning of the pandemic, healthcare workers would visit community members to conduct sample collection for testing. Now, **the samples are taken in a healthcare setting**, unless the patient is unable to move
- An Ag RDT can be done by public doctors at the point of care, but samples for PCR testing often must be transported to a location with necessary equipment
- **Private facilities** can collect samples, but cannot conduct Ag RDT or PCR testing, as per MOH guidelines
- Patient data is collected **during registration at the health care facility's reception**
- Patient data is recorded **on paper form**, then transferred into **Excel**

Trainings and support

- **IPD** initially supported sample testing, but it is now done by **IRESSEF and the national lab**
- **MOH supports training** of IPD, IRESSEF, and other permitted facilities on how to run Ag RDT and PCR tests, as well as training on health information systems

Data collection form



Demographics (patient and household information)	Patient ID number
Symptomatic data (checkbox of symptoms + timing of symptoms)	Recent entry into country
Sampling location	Previous diagnoses
Medical region, district, and post.	Risk factors and medical history

“The difficulty lies in the delivery of the sample and compliance with the transport conditions at the level of the health centre concerned, which can go up to 114km away.”

“At the beginning of COVID-19, it was just demographic aspect. The information requested is now (surname, first name, date of birth, address, symptoms, clinical signs, anticipation (prior tests, vaccinated, other chronic diseases [such as] diabetes...)”



Data reporting



Existing systems

“At the beginning of COVID-19, people called the alert cell, which did the investigation, [were] asking for the necessary information and sent to the affiliated facility according to the patient’s address.”

DHIS 2
Data reporting tool

- **MOH** digital tool for patient data and contact tracing
- Includes clinical information and test results, patient contacts, screening date, and more
- **Districts** also have access to this system

Microsoft Excel
Data collection tool

- Data **transcribed** from paper registration forms and results cards into Excel sheets
- Shared with IPD **every 15 days**
- Excel template exists to **share daily information** on Ag RDTs performed with chief physician, medical region, and MOH

WhatsApp & Email
Patient and HCW communication

- WhatsApp used for sharing **results** and conducting **follow-up** with patient
- HCWs also share **guidance** and ask questions via WhatsApp
- Email used for **sharing reports** to other facilities or MOH

Alert Cell
Patient contact tool

- Phone number people could call at the beginning of the pandemic if they were **symptomatic**
- Phone operator would collect necessary patient information and **send nearby facility worker to patient’s address**

“The information is always shared with the patient at the moment with an explanation provided. If RDT is negative, the patient is recorded on the notification sheet and will then be accompanied to [take another] sample for a PCR. This allows the attending physician to have as well as the chief physician, the medical region, and the MoH. The notification sheets are scanned daily to inform of the RDTs performed, an Excel template is attached to give the daily information.”



Data reporting



Uses for reported data

- **Patient follow-up** by nursing staff (MFI/IMF), including sharing test results and necessary actions to take, as well as contact tracing
- Reporting daily updates, such as number of Ag RDTs performed, to district and regional leadership, as well as the MOH
- Record patients who tested negative by Ag RDT that require confirmatory PCR test
- **Inventory tracking** based on number of Ag RDTs used per day
- **Ag RDT allocation** to different health districts, based on number of patients getting tested in different regions

“The MFI/IMF, made up mainly of the district management team, coordinates to identify patients and share the results of their tests, as well as the actions to be taken. For hospital patients, the information is given to the attending physician and the patient.”

Redundancies and inefficiencies

- **Incomplete information** on registration forms makes it difficult to report and track patients
- Patients do not always have all necessary information
- **Duplicative entry due to** registration data on paper form which must be transferred to Excel
- Time needed to **transfer data** from paper to electronic systems is a key challenge. Double data entry at all health facilities
- Difficulty generating **timely** reports

“More than 10,000 tests are carried out, which is tedious, too many papers/paperwork... in order to have real-time information.”



Supply chain



Supporting organizations



- National Pharmacy distributes Ag RDTs based on notifications received from health districts

“COVID-19 supplies monitored in the testing structure - Stock management (for sampling kits, medicines, etc.) managed by the district management team (management of incoming, outgoing, threshold, etc.)”

Procurement systems



- **Supplies** are managed by testing facilities
- **Stock of supplies** is managed at the district level
- Facilities inform National Pharmacy when Ag RDT **supplies are low**
- National Pharmacy provides additional stock to medical region, which **then allocates Ag RDTs to lower levels**

Supply security issues



- MOH **suspended use** of publicly purchased Ag RDTs due to concerns around test performance
- All COVID-19 tests must be **validated in Senegal** before approved for use

As most interviewees were working at the facility level, they were not dealing directly with the procurement of supplies and unable to provide detailed responses



What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital solution
Referral support 	<ul style="list-style-type: none"> - Patients who present at private facilities are referred to or have samples sent to public facilities to ensure technicians have proper training in Ag RDTs and PCR tests 	—	<ul style="list-style-type: none"> - System to coordinate optimal transport of samples across long distances (up to 114 km)
Patient management 	<ul style="list-style-type: none"> - Initiating symptom treatment while results are pending - Confirmatory PCR testing, regardless of Ag RDT result, ensures fast and improved care of patients 	<ul style="list-style-type: none"> - Communicating results to patients who do not have cell phones 	<ul style="list-style-type: none"> - Digital hub where patients can return to a clinic or any computer to view results, regardless of whether they have a cell phone
Overall clinical management 	<ul style="list-style-type: none"> - Notification sheets of negative results shared with attending physician, chief physician, medical region lead, and MOH - HCWs use WhatsApp to seek advice 	<ul style="list-style-type: none"> - HCW concerns around Ag RDT test performance due to lack of trust in results 	—
Digital record keeping, reporting, surveillance 	—	<ul style="list-style-type: none"> - Time required to transfer data from paper to Excel makes it difficult to generate real-time reports - Missing data can make it difficult to conduct patient follow-up 	<ul style="list-style-type: none"> - Central database for all forms to be used for generating useful reports
Capacity-strengthening 	—	<ul style="list-style-type: none"> - Private facilities cannot conduct Ag RDT or PCR testing due to lack of training and infrastructure 	—
Supply chain support 	<ul style="list-style-type: none"> - National Pharmacy allocates stock of Ag RDTs to medical regions, which allocate to facilities - Ag RDT allocation based on notification reports about daily Ag RDT use in different regions 	<ul style="list-style-type: none"> - Facilities do not have control over supply stock 	<ul style="list-style-type: none"> - Connection between facilities and district level for inventory management
Digital ecosystem	<ul style="list-style-type: none"> - DHIS2 for tracking patient information, sampling date, results, and contact tracing - Sharing reports via email in Excel sheets to inform stock allocation 	<ul style="list-style-type: none"> - Internet connectivity and infrastructure challenges 	—

Country-specific findings

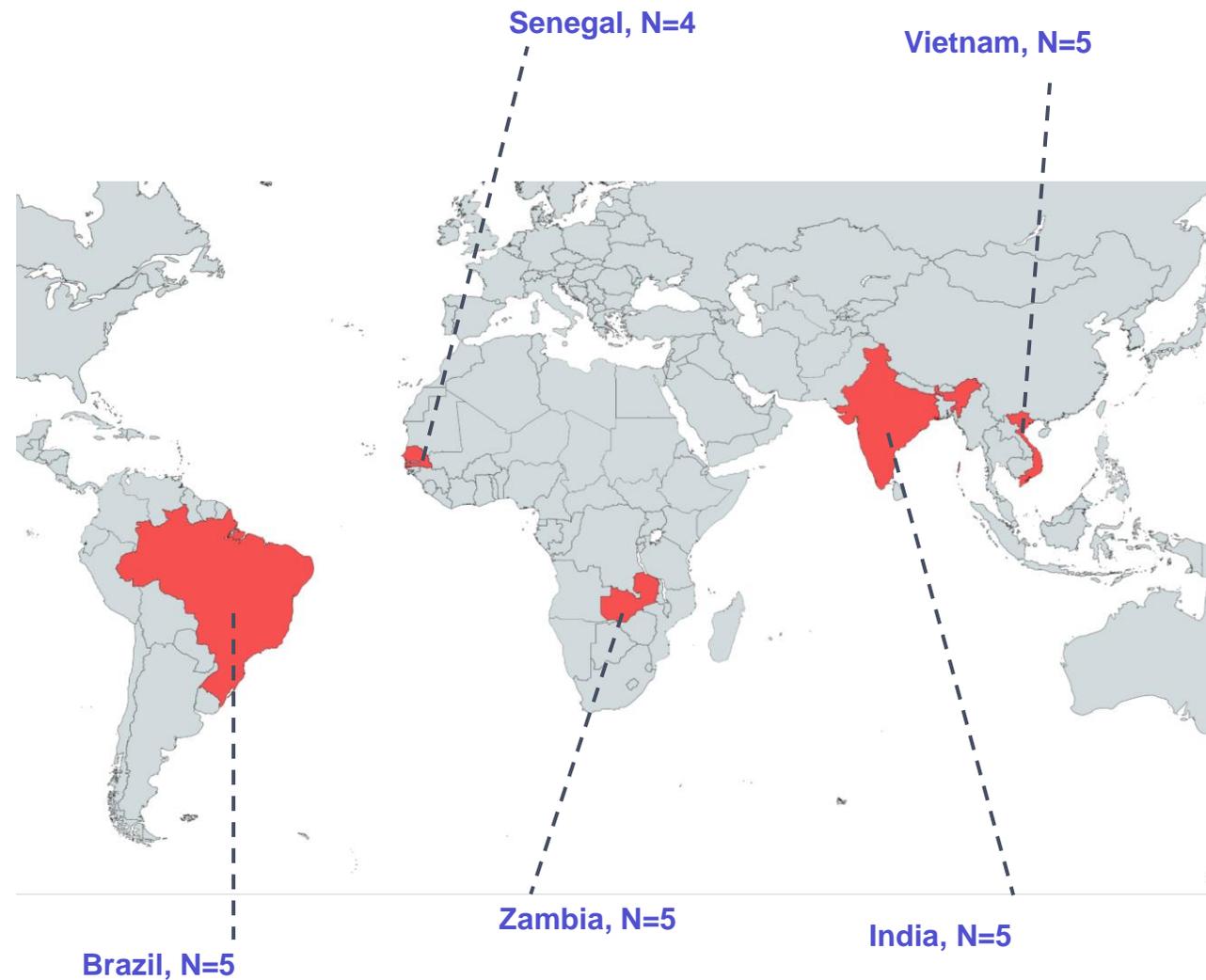
Brazil

India

Senegal

Vietnam

Zambia





Details of interviews conducted in Vietnam

List of abbreviations used in this section:

CDC: Centers for Disease Control and Prevention

DIC: Department of Infection Control

GDPM: General Department of Preventive Medicine

HCW: Health Care Worker

LIMS: laboratory information management system

NIHE: National Institute of Hygiene and Epidemiology

PIHCM: Pasteur Institute in Ho Chi Minh City

Please note the following factors of interviews conducted in Vietnam:

- The COVID-19 situation in Vietnam has evolved very quickly and significantly since these 5 interviews were conducted in May and June 2021, there have been large outbreaks in many provinces and large cities of the country
- As an urgent response to the situation, widespread implementation of Ag RDTs has occurred in August and September 2021, differing from information provided in the interviews
- In September 2021, colleagues in the PATH Vietnam office provided updated information regarding Ag RDT use to supplement what was collected during stakeholder interviews

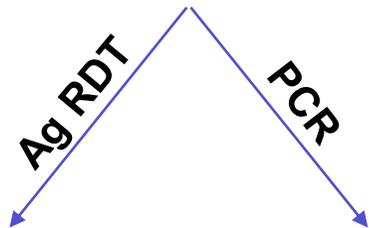


Status of COVID-19 diagnostic testing



Since the onset of the pandemic, the **testing strategy has evolved significantly in Vietnam**. Despite an initial reliance on molecular testing, deployment of Ag RDTs occurred in response to massive outbreaks across the country.

Where does testing occur?



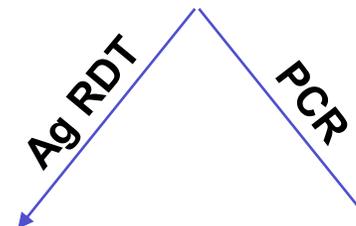
- Provincial CDCs
- Private and public hospitals and labs
- PIHCM
- Community screening test points
- Resident homes
- Factory/business screening sites

- Provincial CDCs
- Private and public hospitals and labs
- PIHCM
- University hospital labs



MOH has provided detailed guidance on how to use Ag RDTs and confirm positive cases by rt-PCR. However, Ag RDT implementation and follow-up activities **differ widely across the country**.

Who gets tested?



- **Travelers** entering the country
- Individuals exiting period of home isolation
- Symptomatic patients presenting at select hospitals for screening
- Individuals living in **outbreak or high-risk areas**
- Shippers, workers, and other **people who provide services** in outbreak or high-risk areas

- Patients with **positive Ag RDT** result

Self-testing with COVID-19 Ag RDT kits has begun and is encouraged in Vietnam

"The MOH currently recognizes only one test to confirm for sure whether a patient has COVID-19 or not, which is the PCR test. The rest of the tests are for screening purposes only. Therefore, when using rapid tests for antibodies or antigens, it is possible to give initial information, for initial processing only. We still need the PCR test to have a confirmatory value. This is specified in the official guidance of the Ministry of Health."



Patient PCR testing process

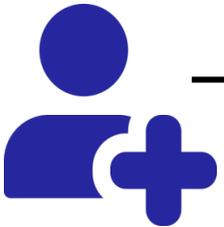


The information presented on this slide reflects the **COVID-19 testing situation as of May and June 2021, before the advent of Vietnam's 4th Wave** – when PCR tests were still primarily used. Patient's experience with Ag RDT are outlined on the following slide.

Patient presents for PCR testing

Patient receives results within 24 hours, but only if positive

Clinical management in the event of a positive result



Patient sample tested in health unit with PCR capabilities

If **positive**, patient receives result verbally from health care provider. Results sheet only available upon request

If **negative**, patient is not informed

If purpose for testing is for **travel**, patients would receive their result directly from the lab and be notified of negative results.

- Patients sent to isolation ward or directed to home quarantine; if seriously ill, patient will be transferred to intensive care unit
- DIC may initiate **contact tracing**
- Provincial CDC reviews results and determines whether patient should be quarantined or released
- **Electronic medical records** are updated to reflect results



Method of returning results varies by case:

1. Screening sample sent by different unit/hospital
2. Patient being treated at same hospital with testing facilities
3. Travelers registering at hospital with testing facilities

"We do not automatically issue the test results for any group of diseases. With the COVID-19 results, we only inform them informally, and do not return result slips. Except for HIV cases, [for which] a paper-based copy will be returned to the patient. This is a regulation of the State."



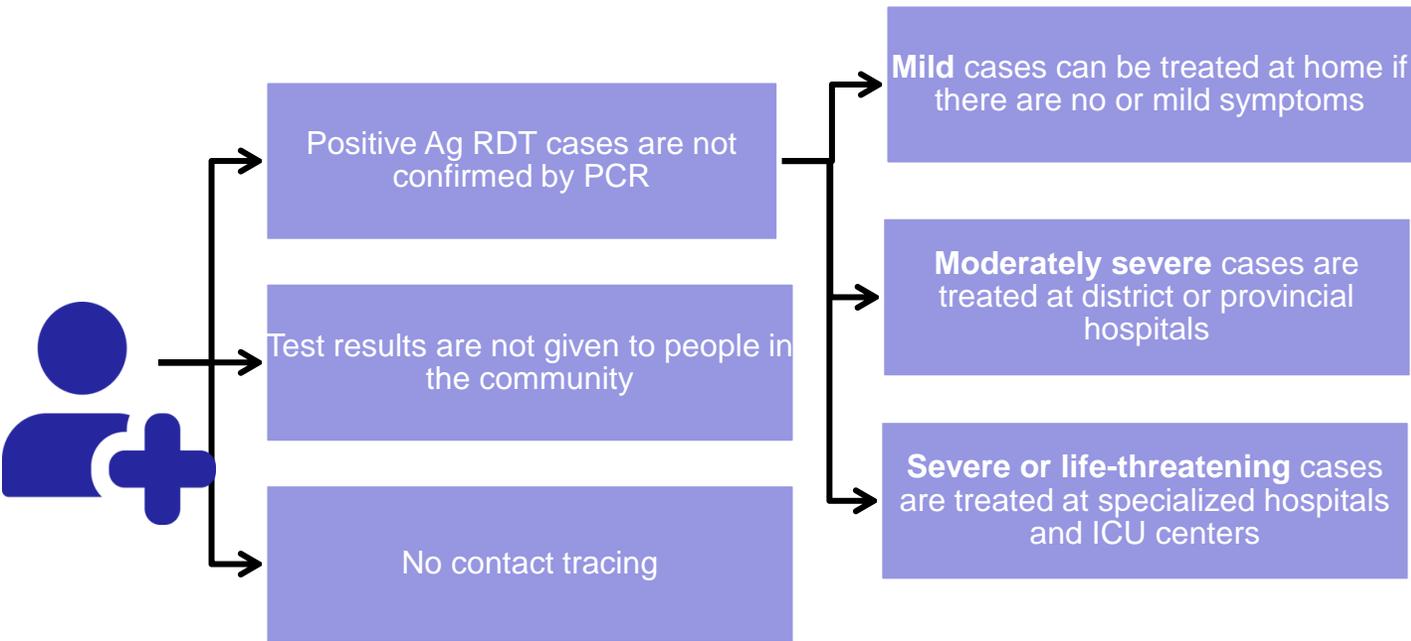
Patient Ag RDT testing process



Although some Ag RDTs were deployed at the discretion of provinces and cities before Vietnam's 4th Wave of COVID-19, the **dynamic and rapidly evolving situation has significantly increased their use within the country.**

Patient presents for Ag RDT at severe outbreak site

Three levels of treatment model for positive result



HCWs may **visit households** in severe and high-risk areas to provide test kits and instruct community members how to conduct Ag RDTs

Examples of Ag RDT use across Vietnam:

In Hanoi people are required to stay home; all non-essential activities have been halted since July, and the city is divided into **red**, **orange** and **green** zones based on infection risk.

Red zone, quarantine camp, and isolation area
3x testing per week

Orange or green zone
1x testing per week

In Southern Vietnam,

Used widely **without confirmatory PCR testing**

Community members encouraged to **self-test** to unburden health system

Across the country as of September 2021,

Outbreak or high-risk areas
1x testing per 1-2 weeks

Shippers, workers, travelers, and other public service providers **use Ag RDT often**

While the MOH has provided guidance on how to use Ag RDTs and confirmatory PCR testing, **the patient and provider experiences differ significantly between regions.**



Provider procedure and training



Facility and testing environment

- Testing occurs in **various settings** such as health care facilities, community testing centers, and occupational settings
- Testing center and healthcare ward configurations are **frequently rearranged** to accommodate patient numbers
- Distancing recommendations are often **violated** at testing sites in severe outbreak areas
- A **critical operations concern** is to ensure all patients are admitted and obtain medical care in a timely manner
- Labs write down patient information on paper form and sample tubes then enter patient data and test results into computer

Trainings and support

- **CDC** used Ag RDT testing to support training in hospitals
- **PIHCM** trains members of Hospital of Tropical Diseases which in turn trains more HCWs at various hospitals
- HCWs and lab technicians have **group chats** to receive advice on treatment, diagnosis, and machine maintenance
- Some interviewees expressed concerns that online/virtual training would be ineffective, and they prefer staff to have **in-person training**

	Community Testing Center	Hospital
Data collection form 	Demographics	Demographics Occupation Previous diagnosis
	Exposure class (F1, F2, etc.)	Exposure class (F1, F2, etc.)
	Sampling location	Risk factors, medical conditions, and symptoms
	Patient code	Patient code

"People have arranged a group chat where we can send a photo/ message the group and get advice from experts in diagnostics, treatment or fixing machines. I find this form of support more convenient [than scheduling a meeting] because [we] don't have time flexibility."

"The most important information is the patient's risk factors, including contact history, such as where they went, with whom they came into contact. We collect all the information according to the regulations of the State. However, during the fight against the pandemic or during community screening, with thousands of samples to be taken, it is difficult for us to collect and fill in all this information form by hand. So, in these cases, we only get general information such as full name, age, address, gender, sampler, sampling date, etc."



Data reporting



Existing systems

LIMS
CDC (preventive sector)

- Works at provincial and district levels for **data importation**
- For NIHE: Tracks specimen collection, epidemiological data, specimen processing, and results returning
- For PIHCM: all the above except sample collection
- Some issues with implementation due to **lack of infrastructure**

Labconn Software
Hospitals (curative sector)

- Data entered in **Excel** spreadsheets and posted to Labconn
- Results and reports can be sent back to hospital via Excel and reuploaded

Microsoft Excel
Data aggregation tool

- Used in conjunction with **Labconn**
- Used by **NIHE**
- **Offline capability** so no requirement for 3G or 4G
- Workforce has existing knowledge of tool, and it is **easy to use** by those with low IT skills
- Able to handle large amounts of data
- Easily **adaptable** to fit needs

Viettel Software/Portal
Lab management

- Used by **provincial CDCs**
- Manages processing specimens, not patient data
- **Automatically appoints tasks** to different unit, depending on stage in workflow
- **Coordinates between** Epidemiology Department and Diagnosis Department
- Some issues with **duplication and syncing** patient codes

VIETTIN
Lab management

- Provides health information system for **testing labs at hospitals**
- Cloud storage capabilities, but **facilities prefer local storage**

“We now have several online software, even free and using open-source codes which allow people to customize to their needs. But it still requires investment in infrastructure. 3G and 4G networks are not available in all communes and districts. And too many entries at the same time can cause system lags. In the situation of COVID-19 pandemic, we have to deal with a large number of samples/specimens, with huge volume of information to manage.”

Viettel and VIETTIN are two of several software companies providing digital lab management solutions



Uses for reported data

Provincial level

- Provinces that lack lab capacity send specimens to NIHE for **confirmation** where they review data before providing results back to health units for patient notification
- Provincial CDCs **manage** test results and **determine** whether patients need to remain quarantined or can be released
- Provincial Department of Health and COVID-19 Provincial Steering Committees receive **all testing reports**
- In some provinces, DIC uses reported data to initiate **contact tracing**

MOH

- GDPM receives list of positive cases and issues patient code to “announce” case and update case count; **currently, because the number of cases increased dramatically, patient codes are not being issued or managed**
- MOH manages a **web-based portal** that contains data related to the epidemic including new cases, old cases, total case count, hospitalizations, treatment, isolation areas, contact tracing, cases in isolation areas, and implementation of activities

Redundancies and inefficiencies

- **Duplicative codes** may be generated for one patient who has been tested multiple times to appear as multiple people
- **Transfer of data** from paper to electronic systems is a key challenge, particularly when COVID-19 case volume is high and in community screening settings
- Different units have **different data reporting requirements** and practices, leading to data discrepancies or redundancies
- Data must be incorporated from **multiple sources** to generate reports
- Many sites have limited internet connections and lack personal connections for work, leading to different levels of access due to **lack of infrastructure or resources**

“I think the biggest challenge is that there is no standard for a medical management software. The same circular is acknowledged and applied differently in different units. It is the same for standardizing data, information [exchange] within the software, etc. There is still no specific standard for all facilities to follow.”



Supply chain



Supporting organizations



- **WHO** provides support for specimen collection kits
- MOH and social health insurance **cover costs of testing**

“We already have multiple available circulars and guidance on which kit to be used as well as their unit price. They have been all well studied and announced by the Ministry of Finance. Hence, we have no choice about brand or price, we can only choose the type of test we want to use.”

Procurement systems



- Microsoft Excel used for supply chain management and inventory tracking
- **Specific warehouse management software**, separate from Labconn, used by hospitals
- Hospital of Tropical Diseases: Lab Department informs Department of Supplies and Faculty of Pharmacy what supplies are needed then Faculty of Pharmacy coordinates receipt of quotes and bidding and gets approval from Director
- CDC: Diagnosis Department informs Finance & Accounting Department of what supplies are needed to conduct purchases
- PIHCM: Supply Chain Management Department provides and manages biological products.
- Departments only request generic items, not specific brands of tests or supplies

Supply security issues



- **Government required procurement** processes are not amenable to emergency situations often stalling supply
- **Supply estimation** is difficult due to rapidly changing situation
- **Fluctuations in pricing** of supplies makes it difficult to get proper funding

What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital tool
Referral support 	<ul style="list-style-type: none"> - Viettel software for sample management and transfer between departments 	<ul style="list-style-type: none"> - Results sheets not provided for patients for potential referral - Lacking sample transfer mechanism 	<ul style="list-style-type: none"> - System to coordinate samples transport (as opposed to personal vehicles/public transportation)
Patient management 	<p style="text-align: center;">—</p>	<ul style="list-style-type: none"> - Difficult to maintain social distancing at community screening sites during COVID-19 outbreaks - Negative results not delivered to patients 	<ul style="list-style-type: none"> - Provide patients with information on COVID-19 and next step - Mental health support for those in need - Facilitation of contact tracing - Artificial intelligence or chat bot to connect with online clinical support
Overall clinical management 	<ul style="list-style-type: none"> - Use of Ag RDT to screen in remote environments 	<ul style="list-style-type: none"> - Different departments/organizations have different data management systems (e.g., epidemiology department vs. testing department) - Concern about Ag RDT performance but unable to confirm with PCR 	<ul style="list-style-type: none"> - Operation system to ensure all patients are admitted and receive timely medical care - Management of at-home self-test results (e.g., use decision logic to provide consultation to people) - Unique patient identification
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Excel is easy to use and adapt to different needs 	<ul style="list-style-type: none"> - Time to collect or transfer data - Incomplete data capture especially in outbreak settings - Complicated administrative procedures and forms preparation associated with reporting - Quality checks are difficult to implement due to lack of standardization 	<ul style="list-style-type: none"> - Ability to evaluate effectiveness of new software - Semi-automation of administrative processes - Centralized data management outside of province level - Disseminating detailed regulations and requirements for software systems
Capacity-strengthening 	<ul style="list-style-type: none"> - Use of group chats to seek guidance and advice from other HCWs 	<ul style="list-style-type: none"> - Limited time available for health professionals - Lack of time for training HCWs on new tools 	<ul style="list-style-type: none"> - Disseminate best practices for HCWs conducting Ag RDTs - Support in-person training with digital learning modules - Moderated forum for HCWs to asynchronously support one another
Supply chain support 	<ul style="list-style-type: none"> - For each health facility, technical departments propose a list of test kits and consumables; financial departments will arrange bidding and procurement of the necessary commodities 	<ul style="list-style-type: none"> - Supply estimation difficult due to rapidly changing situation - Pricing fluctuations make it difficult to secure necessary funding - Mandated bidding process is not amenable to emergency situations 	<ul style="list-style-type: none"> - Real-time supply and inventory management systems receiving data at facility level
Digital ecosystem	<ul style="list-style-type: none"> - Plans to develop overall health information management system 	<ul style="list-style-type: none"> - Investment in infrastructure required to use many existing digital solutions (i.e., internet connection) - Need to pay extra cost to add on COVID-19-specific management modules to existing digital tools - Many regions do not have internet/3G or 4G 	<ul style="list-style-type: none"> - Improve interoperability between existing information systems

Country-specific findings

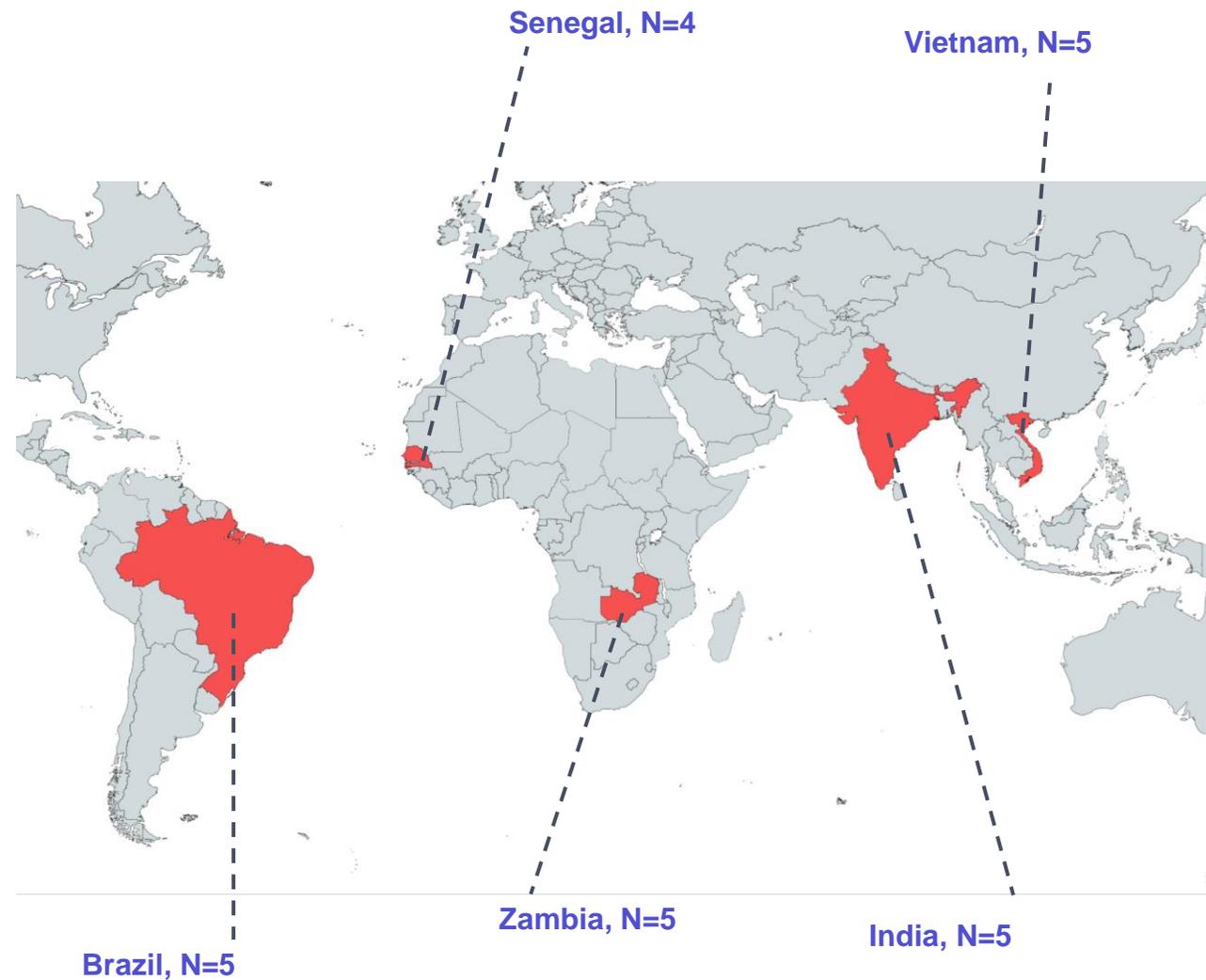
Brazil

India

Senegal

Vietnam

Zambia





Details of interviews conducted in Zambia

List of abbreviations used in this section:

APHL: Association of Public Health Laboratories

CDC: Centre for Disease Control and Prevention

DHIS2: District Health Information Software 2

DisaLab and DisaLink: lab information management software

ODK: Open Data Kit

ZNPHI: Zambia National Public Health Institute

ZAMMSA: Zambia Medicines and Medical Supplies Agency

Please note the following factors of interviews conducted in Zambia:

- The information was gathered during the 3rd Wave of COVID-19, from May to June 2021; since then, guidelines for Ag RDT testing have evolved in some regions
- Some information has been added by the PATH team in Zambia since September 2021

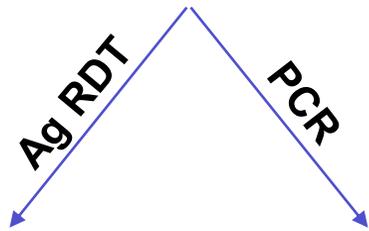


Status of COVID-19 diagnostic testing



Earlier in the pandemic, one had to qualify for COVID-19 testing, but at this time whoever walks in and asks for the test can take the test because there are an **adequate number of tests on the ground**.

Where does testing occur?



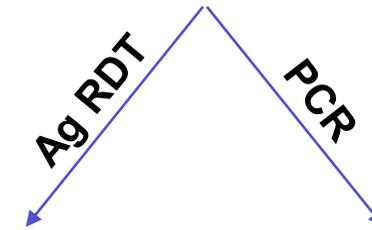
- ~300 sites
- Some high-volume urban facilities
- Rural testing sites

- ~20 sites
- Urban facilities



Data collected is only shared as an **aggregate** and must be **stored in-house**

Who gets tested?



- Initially, anyone could walk in to receive testing
- As supply availability issues increase, as of September 2021, tests are being offered to patients with **symptoms after they have been screened**
- If **Ag RDT is negative**, it is at the discretion of the HCW to order a PCR test especially if the patient is symptomatic
 - Travelers
 - Mass testing

"But specifically for COVID, not every site can wake up today and say 'we are starting to test for COVID.' So there are labs that have been designated to test for COVID."



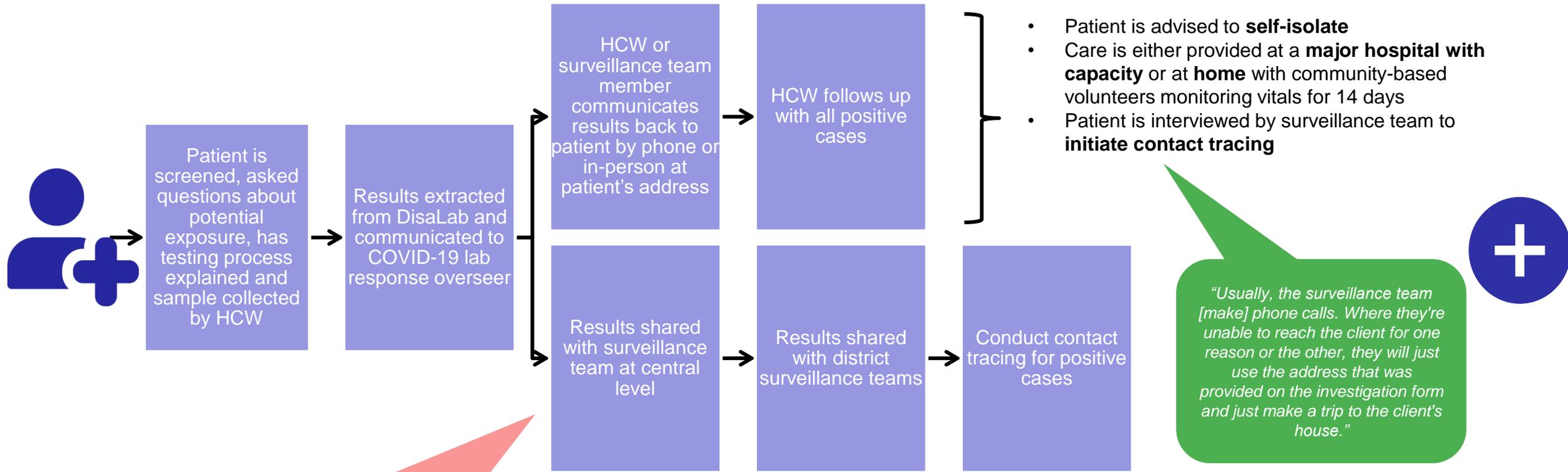
Patient Ag RDT testing process



Patient presents for Ag RDT testing

Patient receives results

Clinical management in the event of a positive result



"Ideally, you're supposed to test them right there and then and the results are available between 15 to 20 minutes, but some of these tests have been aggregated, so clients have to wait a bit to get their results."

"We have inadequacies in terms of reverse data reporting, if I was to put it that way, especially to report back the negative results."

"Usually, the surveillance team [make] phone calls. Where they're unable to reach the client for one reason or the other, they will just use the address that was provided on the investigation form and just make a trip to the client's house."



Provider procedure and training



Facility and testing environment

- Facility staff take down **patient and clinical information** either on hard-copy forms, DHIS2 Tracker, DISA lab system or ODK (few facilities only)
- Systems in use are **open-source**

“For now, we just want to see whether it's feasible to use existing mobile devices in the facilities to record this data”

Data collection form



Name	Gender
Age	Address
Phone number	Locality (e.g. hospital name, institution, district, province)
Epidemic number	Lab ID number
Date specimen collected	Date specimen received
Final result	Date final result reported
Comments	

Trainings and support

- **Facility staff** are trained in COVID-19 testing and management
- Facility staff performing tests must pass **competency assessments** as a form of quality assurance support

“Basically, there needs to be an integration between the DHIS2 tracker and the DISA labs so that this information feeds directly into the National COVID [platform].”

“All the systems that we're using are open-source systems; that's the DHIS2 and ODK.”



Existing systems

DisaLink and DisaLab *Lab information management system*

- Lab fills out **hard copies** of Lab and ZNPHI surveillance forms then input into DisaLab
- **DisaLab** is an information management **software** for labs
- **DisaLink** is a module within DisaLab which allows facilities to remotely pre-register details and test requests, and create barcode labels
- Information entered into DisaLink is **electronically transferred** to DisaLab

KoboCollect *Data collection tool*

- Currently being used in **Lusaka** province and at **ZNPHI**
- Application in ODK Collect platform for **primary data collection**
- Discussions are taking place to assess **integration** of KoboCollect with lab information systems
- Line-list generated and sent to ZNPHI for forward **reporting**

DHIS2 Tracker *Data collection tool*

- Currently being **piloted** at 20 testing sites
- **Evaluating feasibility** of using existing mobile devices in facilities to record data

Microsoft Excel *Data sharing tool*

- **Paper-based line** list form details all RDTs conducted within 24 hours at **facility level**
- Either imported into Excel sheet or photo of paper-based form sent through **WhatsApp**
- Facility data aggregated into new Excel sheet and sent to **provincial health office** by email

SMARTCARE *Electronic health record*

- EHR system for **hospitals and healthcare facilities**
- Discussions are taking place as to how this will be **integrated** into DisaLab

“Most of their labs that are doing COVID-19 testing have Disa. So, these results are entered into DISA, are authorized, extracted and they are sent to central level where consolidation and reporting is done. So, all results are sent to central-level and they are electronic.”

“And one of the other tools in terms of, for example, viral load and [early infant diagnosis], there is Smartcare that is being used.”

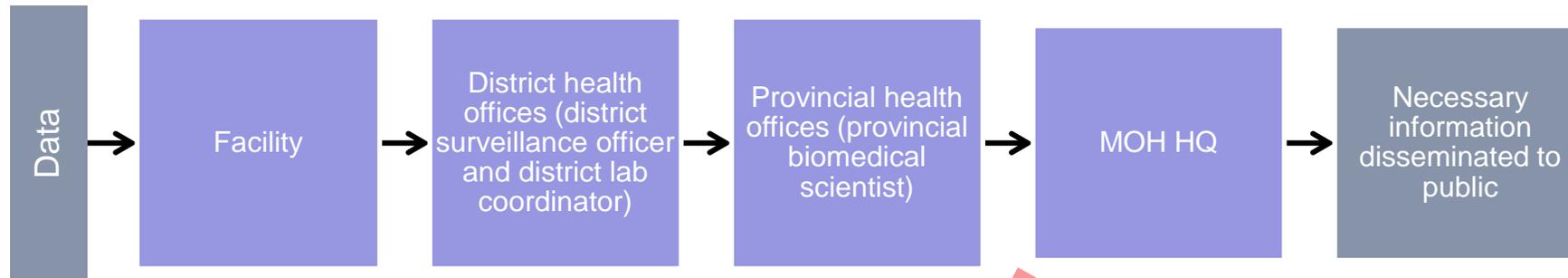


Uses for reported data

- Data is stored locally in **physical servers** at Infratel (formerly Zambia National Data Centre)
- **Data visualization** dashboards available at MOH. Only MOH has access to certain **confidential data**
- **Every 24 hours** the following data is reported: total number of tests conducted, number of positive cases, number of negative cases, and where samples originate from.

Redundancies and inefficiencies

- **Transfer** of hard-copy information into digital platform for centralized reporting
- Lack of **standardized** digital data recording tools directly linked to or integrated with DisaLab
- Varying levels of data quality and **data fields collected** depending on the facility



“Remember that in responding, controlling the pandemic, what’s most important is to be able to identify the cases, isolate them, that’s how we break through our contact tracing. And that’s how we break the chain of transmission. So, this data is helpful, because when we identify in the lab, they then use this data to do their contact tracing, identify these cases, and quarantine them and do their contact tracing.”

“Depending on what is coming out of the lab, again, for instance, the positivity rates, whether it’s at national level or in different provinces, will also guide; for instance, we had to revise our what I would call it - it is a testing strategy. Who should we target? Should we just go in the market and test everyone? Should we just focus on those people who have symptoms or contacts of known cases?”



Supply chain



Supporting organizations



- Clinton Health Access Initiative
- US Agency for International Development
- Chemonics
- CDC
- Global Fund

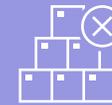
“Every day as facilities are reporting in the line list results, they also submit the logistics data in terms of their stock availability.”

Procurement systems



- Procurement processes **differ** between single sites and at the national level
- Single sites/labs: Requests for **equipment** (e.g., PCR machines are through direct procurement request by heads of departments to MOH)
- National level: Sites request for **consumables/commodities** (e.g., Ag RDTs, PPE, etc.) by submitting commodity usage reports to ZAMMSA. **ZAMMSA** is responsible for distribution of required supplies to sites across the country
- Commodities requests through ZAMMSA occur bimonthly and are through a digital, **e-logistics management system** for usage reporting

Supply security issues



- Numerous **administrative hurdles** to access supplies
- **Variable usage** of e-logistics management system and paper-based utilization reports

“Procurement cannot act unless there is an approved request and budget from the controlling officer.”

What's working, what's not?

	What's working	Challenges	Opportunities to leverage a digital tool
Referral support 	<ul style="list-style-type: none"> - HCWs follow up with patients who test positive either by phone or physically at the address they provided 	<ul style="list-style-type: none"> - Missing or incorrect patient information (e.g., names, addresses) 	<ul style="list-style-type: none"> - Data verification features for data entry - Creating linkages between lab, surveillance, and clinical teams to share data
Patient management 	<ul style="list-style-type: none"> - HCWs and surveillance team members reach patients either by phone or physically at the address they provided 	<ul style="list-style-type: none"> - Inconsistent communication of results, especially for negative cases 	<ul style="list-style-type: none"> - Inform patients of test result through mobile app
Overall clinical management 	<ul style="list-style-type: none"> - Contact tracing initiated by surveillance team upon positive test result 	<ul style="list-style-type: none"> - Misapplication of Ag RDT due to shorter turnaround time 	<ul style="list-style-type: none"> - System focused on clerk or data personnel at sample-collection site to streamline data capture
Digital record keeping, reporting, surveillance 	<ul style="list-style-type: none"> - Multiple data collection tools and management systems 	<ul style="list-style-type: none"> - Incomplete information during data capture - Inadequacies in negative result data reporting - Data transcription errors - Underreporting especially due to digital infrastructure issues - Variation across sites of data being captured 	<ul style="list-style-type: none"> - Mobile data collection tool focused on reducing transcription errors - Require some minimum amount of data to improve data quality - Provision for laypeople to input information into surveillance tool
Capacity-strengthening 	<ul style="list-style-type: none"> - Competency assessments for HCWs 	<ul style="list-style-type: none"> - Poor adherence to guidelines - High turnover of staff trained to conduct COVID-19 test often due to career advancement - HCWs must take work home with them to ensure reporting 	<ul style="list-style-type: none"> - Digitize and disseminate notifications and guidelines to HCWs
Supply chain support 	<ul style="list-style-type: none"> - MOH and Zambia Medicines and Medical Supply Agency (ZAMMSA) work well together 	<ul style="list-style-type: none"> - Multiple channels of procurement for different supplies 	<ul style="list-style-type: none"> - Semi-automated inventory management to directly report usage to ZAMMSA
Digital ecosystem	<ul style="list-style-type: none"> - Effective access control for confidential health and testing data - Connectivity support to DisaLab 	<ul style="list-style-type: none"> - Blackouts and connectivity/internet challenges - Lack of computers and related infrastructure - Data security issues 	<ul style="list-style-type: none"> - APIs to integrate existing information systems - Build upon existing HIV notification program to inform patients and caregivers of test result

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