Digital health systems to support pandemic response in **Rwanda**

Mapping digital health tools and matching deployment opportunities in response to COVID-19
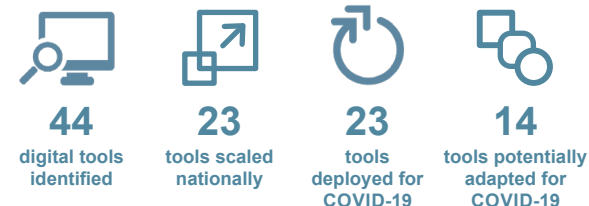
May 2021

IN THIS TECHNICAL BRIEF

Introduction

Rwanda's Ministry of Health (MOH) outlines its priority for strengthening health information systems in its *The National Digital Health Strategic Plan: 2018–2023.* The Government of Rwanda's vision is to use ICTs to transform the health sector by employing specific policy directions, such as strengthening interoperability of health information systems and improving health service delivery and accessibility through digital health. The COVID-19 pandemic brought a new level of urgency to this health sector transformation. Leveraging digital health tools is a rapid, cost-effective strategy to accelerate Rwanda's COVID-19 response while at the same time reinforcing the MOH's vision.

Background

Digital Square conducted a landscape analysis of Rwanda's digital systems in the ten-year period from 2010–2020 with information validated by tool implementers and designers, digital health experts, and MOH stakeholders as part of the USAID-funded Map and Match project. The purpose was to identify the existing digital tools used in Rwanda, map the tools already deployed for COVID-19 response to relevant uses cases, and highlight opportunities where existing tools can quickly be adapted and deployed to support COVID-19 response.

44 digital tools identified

23 tools scaled nationally

23 tools deployed for COVID-19

14 tools potentially adapted for COVID-19

Analysis overview

Digital Square's analysis found that Rwanda's health system uses 44 digital health tools with at least 23 already deployed for COVID-19 response. This brief identifies opportunities for existing digital tools to be adapted to pandemic use case needs for the COVID-19 response and potential future epidemics. Mapping tools to the use cases revealed where there are strengths and gaps in Rwanda's digital health systems response to COVID-19. For example, the analysis identified only tool addressing health facility and provider administration with additional tools ready for adaptation to further tackle this use case.

Strategic adaptation of existing digital health tools will accelerate the COVID-19 response, offering greater efficiency and more robust support to the government, health workers, clients, and other stakeholders.

Figure 1. Current number of digital health tool deployments mapped to pandemic use cases in Rwanda.
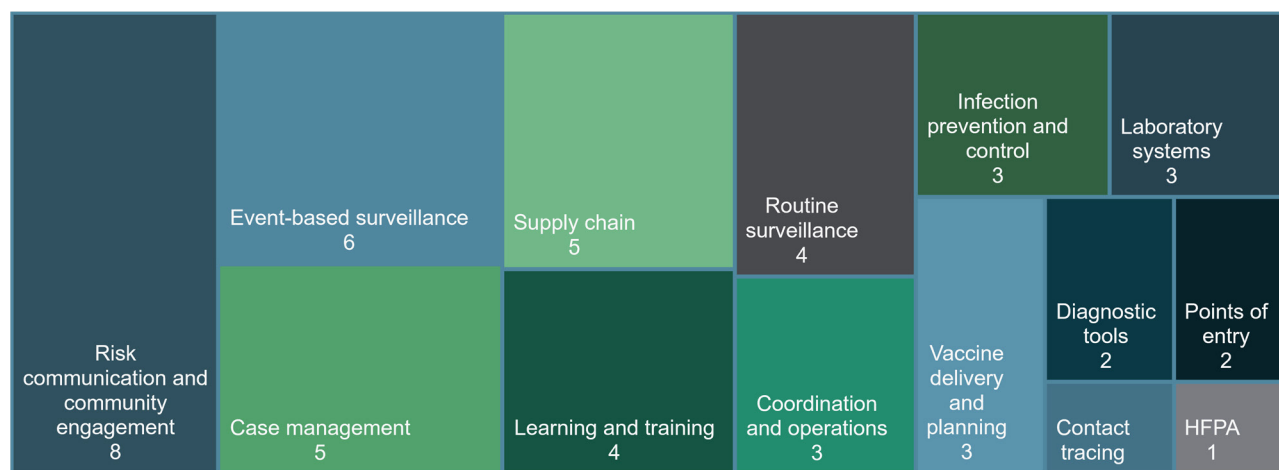
Figure 1 illustrates that many use cases are addressed using several tools in Rwanda's COVID-19 response while other use cases are filled by few tools.

HFPA= Health facility and provider administration

Key definitions

Pandemic use case refers to the specific type of information collected, stored, tracked, analyzed, or visualized as it relates to the functional response to an epidemiological event, specifically COVID-19.

Digital health tool refers to a website, application, or other computer or mobile technology that supports data collection, storage, tracking, analysis, or visualization. The tool must have an electronic interface. One digital tool can address multiple use cases.

Application refers to components of digital tools that are primarily designed for use by clients of the health system or by health workers. Applications can be reused to address more than one use case, or applications can be uniquely used for only one use case.

Adaptation refers to making improvements to existing digital tools to improve their applicability and impact in the context of COVID-19.

Table 1. Mapping and matching digital health tools to strengthen Rwanda's COVID-19 response.

Digital Square mapped the current state of tools' functionality across the pandemic use cases in **blue** to illustrate how the digital health systems are supporting Rwanda's COVID-19 response. Digital Square matched opportunities for tool adaptation across the pandemic use cases in **green** to reveal places where Rwanda can reuse parts of its existing digital health systems to strengthen its COVID-19 response.

PANDEMIC USE CASES

Tool	Case management	Contact tracing	Coordination and operations	Diagnostic tools	Event-based surveillance (including rapid response teams, case investigation)	Health facility and provider administration	Infection prevention and control	Laboratory systems	Learning and training	One Health	Points of entry	Risk communication and community engagement	Routine surveillance	Supply chain	Vaccine delivery and planning
3-2-1 Service							green		blue			blue			
Amplio Talking Books									blue			blue			
Anti-Epidemic Robots	blue			blue			blue				blue				
Audiopedia												blue			
CommCare	blue	green			green	green	green	green	green		green	green			
E-Heza Data Solutions	blue	green		blue	blue		blue								
Electronic Infectious Disease Surveillance and Response (eIDSR)					blue										
eLMIS			blue											blue	
Kasha														blue	
Longitudinal surveys conducted via Interactive Voice Response (IVR) for resilience impact assessment		green		green			green					green	blue		
Mbaza												blue			
mUzima for Health Providers	blue				blue										
OpenHIE/Open Health Information Mediator (OpenHIM)															
RapidPro												blue	green		
RECOVR													blue		
Rwanda Biomedical Centre Health Facility Level Services			blue				blue					blue			
Rwanda Health Analytics Platform			blue		blue							blue	blue	blue	blue

■ Digital tools deployed for COVID-19 response   ■ Opportunities to adapt tools for pandemic response

Table 1. Mapping and matching digital health tools to strengthen Rwanda's COVID-19 response, continued.

PANDEMIC USE CASES

	Case management	Contact tracing	Coordination and operations	Diagnostic tools	Event-based surveillance (including rapid response teams, case investigation)	Health facility and provider administration	Infection prevention and control	Laboratory systems	Learning and training	One Health	Points of entry	Risk communication and community engagement	Routine surveillance	Supply chain	Vaccine delivery and planning
Rwanda HMIS (DHIS2+ Tracker)	🟢	🟢	🟢	🟢	🔵	🟢		🔵				🟢	🟢	🟢	🔵
Viamo									🔵			🔵			
VigiFlow								🔵					🔵	🔵	
WelTel	🔵	🔵			🔵			🔵			🔵				
World Continuing Education Alliance									🔵						
Zipline Drone Delivery Service							🔵							🔵	🔵
Babylon Health	🟢	🟢		🟢											
Cadasta platform													🟢		
ColdTrace														🟢	🟢
Computer-Aided Detection for Tuberculosis (CAD4TB)	🟢			🟢	🟢		🟢								
CyberRwanda									🟢			🟢			
DataToCare	🟢		🟢		🟢			🟢							
East, Central, and Southern Africa (ECSA) TB Supply Chain Portal			🟢											🟢	
iHRIS						🟢									🟢
Integrated Supportive Supervision (ISS)	🟢														🟢
OpenMRS	🟢	🟢			🟢	🟢						🟢			🟢
Quantimed														🟢	
Reveal															🟢
U-Report												🟢	🟢		
WelTel			🟢	🟢		🟢	🟢					🟢			🟢

🔵 Digital tools deployed for COVID-19 response 🟢 Opportunities to adapt tools for pandemic response

Matching digital health tools ready for adaptation to fill the pandemic use case gaps

The Digital Square analysis identified existing digital tools that can be adapted to support COVID-19 response for two use case gaps below. Use case gaps are defined as use cases that have fewer than two digital tools currently implemented to address this technical area. Many of these tools also provide opportunities to streamline the COVID-19 response across a range of use cases. One Health is the sole use case where no existing tools or adaptation was matched, making it a complete gap in the COVID-19 response

To learn more about the tools in the matrix below, please see Table 2 for more details to facilitate adaptations. To find out more about all the Digital Square–approved global goods mapped across these pandemic use cases, please see this Map and Match resource, which can provide decision-makers with targeted information to deploy and adapt global goods to fulfill gaps in the COVID-19 response.

Contact tracing

WelTel	Babylon Health
CommCare	Rwanda HMIS (DHIS2 + Tracker)
E-Heza Data Solutions	Longitudinal surveys conducted via IVR for resilience impact assessment
OpenHIE/OpenHIM	OpenMRS

Health facility and provider administration

Rwanda Biomedical Centre Health Facility Level Services	CommCare
Rwanda HMIS (DHIS2 + Tracker)	iHRIS
OpenMRS	WelTel

One Health

No tools or adaptations identified

Examples of global goods adapted and deployed for COVID-19 response in Rwanda

iHRIS

iHRIS is a free and open source software solution that forms an integrated human resources information system, enabling countries to more easily collect, maintain, and analyze health workforce data and manage health workforce resources at the MOH, district health offices, and health care facilities.

iHRIS is built on a flexible framework that can be adapted to meet a wide variety of needs for managing health workforce information. iHRIS supports the MOH and other service delivery organizations to:

- Track, manage, deploy, and map their health workforce.
- Predict workforce changes and needs under different scenarios.
- Plan and cost workforce retention interventions.
- Manage training activities, including pre-service and in-service education.

iHRIS can be adapted to support COVID-19 response to manage and track health workers' vaccinations and to conduct workforce planning for COVID-19 hotspots and staffing needs (e.g., personal protective equipment). The Kenya MOH has used iHRIS to identify potential workforce shortages and to plan for redeployment based on likely COVID-19 hotspots.

2 PANDEMIC USE CASES

Health facility and provider administration
Vaccine delivery and planning

0 USE CASES UTILIZED

2 ADAPTATION OPPORTUNITIES IDENTIFIED

Rwanda HMIS (DHIS2 with Tracker)

Rwanda's HMIS is built on DHIS2, which is an open source, web-based HMIS platform. DHIS2 supports the collection, analysis, visualization, and sharing of both aggregate and individual-level data (using Tracker), including mobile and offline data collection using the DHIS2 Android app.

DHIS2 has several ready-to-install digital data packages to support COVID-19 surveillance and response based on WHO guidelines. DHIS2 has a COVID-19 Surveillance Event Program (i.e., an event-based surveillance program), which is a simplified line list to capture a subset of minimum critical data points to facilitate rapid analysis and response. DHIS2 strengthens contact tracing by enabling identification and follow-up of contacts of a suspected or confirmed COVID-19 case. COVID-19 case-based surveillance enrolls and tracks suspected cases; captures symptoms, demographics, risk factors, and exposures; creates lab requests and captures laboratory data about the case; links confirmed cases with contacts; and monitors patient outcomes.

12 PANDEMIC USE CASES

3 USE CASES UTILIZED

9 ADAPTATION OPPORTUNITIES IDENTIFIED

Case management
Contract tracing
Coordination and operations
Diagnostic tools
Event-based surveillance
Health facility and provider administration
Laboratory systems
Points of entry
Risk communication and community engagement
Routine surveillance
Supply chain
Vaccine delivery and planning

Table 2. An in-depth look at digital health tools to support the COVID-19 response.

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
3-2-1 Service	Viamo's 3-2-1 Service is a toll-free, automated information hotline available in 18 countries. Subscribers can access information hosted on this hotline by dialing a toll-free, short-code (such as 3-2-1) and then easily navigating a menu of topics with various options, such as "Press 1 to learn about the symptoms of COVID-19" or "Press 2 to learn how to prevent the spread of COVID-19." Messages are distributed on mobile telephones (i.e., smart or feature), and made available for free on the service as part of Viamo's prenegotiated agreements with MNOs. The 3-2-1 Service communicates information through audio using IVR technology, which allows anyone, regardless of literacy level, to access the information. The service can host both static and dynamic content, which is recorded by native speakers in local languages, validated by experts and approved by the relevant government stakeholders. For COVID-19, Viamo worked with outbreak experts and relevant local stakeholders to identify key messages to increase awareness of health services relating to COVID-19 and share those messages to almost anyone, on-demand. In 2020, 6.8 million people across the world called the 3-2-1 Service to learn more about COVID-19. Additionally, Viamo implemented a COVID-19 symptom checker on the 3-2-1 Service in Malawi, Mali, and Uganda in partnership with Surgo Ventures. More than 100,000 people have completed the symptom checker, many of whom are classified as "high risk."	**Infection prevention and control, learning and training, risk communication and community engagement**	CARE, Girl Effect, GIZ, Legal Aid Forum, SGO, Viamo, World Bank	Access to Finance Rwanda, African Entrepreneur Collective, CARE, Girl Effect, Inkomoko, Legal Aid Forum, MOH, Save the Children, SGO, Sparkassen Stiftung, Viamo, World Vision	Freemium	National
Amplio Talking Books	The Amplio Talking Book is a rugged, battery-powered audio device for low-literate adults and youth that delivers local language messaging. Governments and development organizations use Talking Book to amplify their reach and share knowledge in remote communities. Talking Book overcomes barriers such as lack of infrastructure, illiteracy, and traditional gender norms and biases that often limit access to information. Talking Book has a cloud-based technology platform, an app to load new content and collect usage data and user feedback in the field, and a dashboard for monitoring and evaluating data for each community. UNICEF Rwanda and GHDF have 300 Talking Books from previous projects. Rwanda plans to take existing COVID-19 messaging and record them on the Talking Books to use with populations in refugee camps.	**Learning and training, risk communication and community engagement**	Government of Japan, Paul and Cathy Cotton Family, UNICEF	GHDF	Open source	Subnational
Anti-Epidemic Robots	The UNDP Accelerator Lab partnered with the Ministry of ICT and Innovation to acquire and deploy five smart anti-epidemic robots for use in two COVID-19 treatment centers and at the Kigali International Airport. The robots support detection of COVID-19 cases (e.g., for returning citizens), test patients, and provide other services in the hospitals. The robots are used to administer temperature checks, monitor patient statuses, and keep medical records of COVID-19 patients.	**Case management, diagnostic tools, infection prevention and control, points of entry**	ZoraBots Africa Ltd	Rwandan Ministry of ICT and Innovation, UNDP	Proprietary	
Audiopedia	Audopedia is an ecosystem of localized digital audio content and technologies for social behavior change communication campaigns. Audopedia includes audio health education delivered through web applications for smart phones and feature phones. For COVID-19, Audopedia published the Corona WhatsApp Audio Campaign on Audiopedia.IO. Recorded messages can be shared through WhatsApp and fight fake information.	**Risk communication and community engagement**		DAHW	Open source	
CommCare	CommCare is an offline-capable mobile data collection and service delivery platform used in more than 80 countries. CommCare is popular for its offline case management capabilities proven to be effective at scale. It is designed for everything from simple surveys to comprehensive longitudinal data tracking. It allows for easy digitization of surveys, has forms that are intuitive for end users, utilizes simple device deployment, and includes translation features.	**Case management, contact tracing, event-based surveillance, health facility and provider administration, infection prevention control, laboratory systems, learning and training, point of entry, risk communication and community engagement**		CRS	Open source	National

■ Digital tools deployed for COVID-19 response   ■ Opportunities to adapt tools for pandemic response

Table 2. An in-depth look at digital health tools to support the COVID-19 response, continued.

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
E-Heza Data Solutions	E-Heza Data Solutions is used to support health workers in the catchment area of Ruli District Hospital and MOH. E-Heza is the first point-of-care digital data collection system used by nurses and CHWs. E-Heza supports FHWs to adopt evidence-based clinical care protocols, to provide high-quality care, and to use real time data trends to tailor health education to individual family needs. The systems satisfies the MOH's data reporting requirements. E-Heza's unique design serves as an effective end-user interface that integrates with national databases such as OpenMRS and DHIS2, as a stand-alone 'lite' health record, or a specific data collection tool. E-Heza's Acute Illness module allows a CHW to walk through a symptom review, travel and exposure history. If the community member reports symptoms and history consistent with COVID-19, the CHW is immediately advised to isolate and call the health center before ever coming into physical contact with the patient. If the patient is not a suspected to have COVID-19, the CHW can continue the clinical assessment and will be guided through decision-making process for evaluation, treatment, and referral. The progress report provides an initial assessment, differential diagnosis where appropriate, highlights the timeline of signs and symptoms, describes actions taken and next steps. Progress reports can be used and accessed by their entire care team at all levels of care for patient services management. activities	**Case management, contact tracing, diagnostic tools, event-based surveillance, infection prevention and control**	Global Fund, Grand Challenges Canada Transition to Scale, Johnson & Johnson	East African Health Research Commission, Global Fund, Health Builders, MOH, TIP Global Health (formerly the Ihangane Project)	Open source	Subnational
Electronic Infectious Disease Surveillance and Response (eIDSR)	Rwanda's eIDSR system uses mobile technology and IVR to monitor and respond to disease outbreaks. The eIDSR is a customized module on the DHIS2 reporting platform. Staff at district hospitals and health centers enter data into the eIDSR system for 24 diseases. Once the number of cases for a specific disease reaches a certain threshold, as defined by the RBC, the eIDSR system sends an outbreak alert to district hospitals, health centers, and the Epidemic Surveillance and Response team of the RBC. For COVID-19, case investigation forms are being entered into eIDSR to track suspected and confirmed cases.	**Event-based surveillance**	CDC, USAID	MOH, MSH, RBC	Open source	National
eLMIS	Vitalliance's eLMIS provides real time inventory data, contraceptive order visibility and processing and warehouse management. eLMIS provides data on pharmaceuticals and other medical commodities in the supply chain and tracks their flow from distribution centers dotted around the country to hospitals, clinics and ultimately to the patients. The system also tracks expiration dates, so that older medicines can be prioritized and consumed so there is less waste. Vitalliance LMIS is available as a cloud-based SaaS, and it supports multi-user interfaces for web browsers, smartphones and tablets.	**Coordination and operations, supply chain**	Global Fund, USAID GHSC-PSM	USAID GHSC-PSM	Open source	National
Kasha	Kasha is an e-Commerce solution that focuses on pharmaceuticals and other health products. Kasha sells menstrual care products, contraceptives, pharmaceuticals and a range of beauty products via its own platform, accessible through basic phones and a website. Kasha delivers to customers confidentially and aims to be a trusted source of information, especially around stigmatized products. Kasha serves as a safe way to procure hand sanitizers, antibacterial soaps, masks, gloves and COVID-19 diagnostic rapid tests.	**Supply chain**	Finnfund	Kasha	Proprietary	
Longitudinal surveys conducted via Interactive Voice Response (IVR) for resilience impact assessment	In Uganda, Ghana, Kenya and Rwanda, Viamo deployed longitudinal surveys to monitor the impact of programs, COVID-19, and lockdowns on beneficiaries of MasterCard Foundation's grantees. These surveys use IVR technology, which allows anyone, regardless of literacy level, to access the information. In Rwanda, the survey is targeted to participants of a program that provides business development support and grant funding to more than 3,500 micro, small and medium-sized enterprises that require working capital or re-launch capital due to the impact of COVID-19 on their businesses. Survey results are shareable with other health information management and reporting platforms via open data standards, including the Flow Interoperability standard, a REST API, SQL, and Google BigQuery.	**Contact tracing, diagnostic tools, infection prevention and control, risk communication and community engagement, routine surveillance**	Mastercard Foundation	Viamo	Proprietary	National
Mbaza	Mbaza is a COVID-19 chatbot that can be accessed on any phone used in Rwanda. The solution provides access to valuable COVID-19 information in plain language on any phone at any time and enables feedback connecting people to the authorities. It allows citizens to raise concerns and to provide governments with information on the local situation.	**Risk communication and community engagement**	European Commission Smart Development Hack	Digital Umuganda, Rwanda Utilities and Regulations Authority	Proprietary	

■ Digital tools deployed for COVID-19 response   ■ Opportunities to adapt tools for pandemic response

Table 2. An in-depth look at digital health tools to support the COVID-19 response, continued.

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
mUzima for Health Providers	mUzima is a mobile extension to the widely deployed OpenMRS electronic record system, and it improves the reach of clinical care beyond tethered and connected settings. mUzima innovatively utilizes mobile technology to improve the health of the underserved across all care domains. mUzima handles multiple use cases (e.g., HIV, HTS, outreach, CDM), adds forms without repackaging, allows users to view historical data as well as capture data, handles record deduplication, and enforces security. mUzima has been modified and used as case management tool in inpatient settings for COVID-19 response.	Case management, event-based surveillance	Norad, USAID	MOH, PIH	Open source	Subnational
OpenHIE/Open Health Information Mediator (OpenHIM)	The OpenHIE architecture supports interoperability by creating a framework that leverages health information standards, enables flexible implementation by country partners, and supports interchangeability of individual components. Implementing an interoperability layer improves public health reporting by facilitating tool integration. OpenHIM is a middleware component designed to ease interoperability between disparate information systems. It provides secure communications and data governance as well as support for routing, orchestrating, and translating requests as they flow between systems.	Interoperability			Open source	National
RapidPro	RapidPro is an open source platform that allows anyone to build interactive messaging systems using an easy visual interface.	Risk communication and community engagement, routine surveillance		Praekelt	Open source	National
RECOVR	Tracking how people's lives are affected by the COVID-19 pandemic can enable policymakers to better understand the situation in their countries and make data-driven policy decisions. To respond to this need, IPA has developed the RECOVR survey—a panel survey that will facilitate comparisons, document real time trends of policy concern, and inform decision-makers about the communities that are hardest-hit by the economic toll of the pandemic.	Routine surveillance	Gates Foundation, Northwestern University's Global Poverty Research Lab, UBS Optimus Foundation	IPA, SurveyCTO	Open source	
Rwanda Biomedical Centre Health Facility Level Services	The Rwanda Biomedical Centre Health Facility Services is an online national health facility database and dashboard that includes information on where to find local health facilities, information for travelers, booking for COVID-19 tests, online portal for COVID-19 test results, and additional COVID-19-related informational resources.	Coordination and operations, health facility and provider administration, risk communication and community engagement	MOH	MOH		National
Rwanda Health Analytics Platform	Zenysis Analytics Platform is a commercial-off-the-shelf data integration and advanced analytics platform that is currently used by national and state public health entities to enable data-driven emergency response activities, as well as routine program and resource management. This platform integrates many siloed systems for the MOH. Zenysis integrates structured data from any available and relevant source (e.g, routine public health data from DHIS2, sentinel surveillance data, EMR and patient-level data, logistics and supply chain data, human resources data), both within and beyond the health sector, into a single unified workspace for decision-makers addressing COVID-19. These workspaces, or "Virtual Control Rooms," enhance situational awareness and disease surveillance and provide decision-makers the actionable analytics they need to coordinate containment efforts in a data-driven way. Within the Virtual Control Room, decision-makers have access to near real time, high-resolution analytics that help them take and coordinate effective action. These analytics are available through easy-to-use visualizations and dashboards that can also be shared to keep the public and partner organizations informed of developments. Zenysis enables contact tracing and case management, runs cohort analyses, sets alerts, produces weekly COVID-19 surveillance reports, and accelerates operational decision-making.	Coordination and operations, event-based surveillance, risk communication and community engagement, routine surveillance, supply chain, vaccine delivery and planning	GAVI, Global Fund	MOH, MTEK Sciences, RBC, Zenysis	Proprietary	National

■ Digital tools deployed for COVID-19 response   ■ Opportunities to adapt tools for pandemic response

Table 2. An in-depth look at digital health tools to support the COVID-19 response, continued.

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
Rwanda HMIS (DHIS2+ Tracker)	DHIS2 is an open source, web-based platform, typically used as a national health information system for data management and analysis purposes, for health program monitoring and evaluation, facility registries and service availability mapping, logistics management, and mobile tracking of pregnant mothers in rural communities. DHIS2 supports the collection, analysis, visualization, and sharing of both aggregate and individual-level data, including mobile and offline data collection using the DHIS2 Android app. DHIS2 is deployed in more than 70 countries. In Rwanda, the field sample collection program uses more than 300 Android tablets that are distributed to sample collectors, quarantine sites, and health facilities around the country to track COVID-19 through Rwanda's HMIS. Rwanda uses the COVID-19 Vaccine Delivery System and the DHIS2 Tracker and Android App to conduct COVID-19 sample collection, lab testing, and to share results in a paperless format from start to finish.	**Case management, contact tracing, coordination and operations, diagnostic tools, event-based surveillance, health facility and provider administration, laboratory systems, points of entry, risk communication and community engagement, routine surveillance, supply chain, vaccine delivery and planning**	Gavi, Global Fund, Norad	HISP Rwanda, MOH	Open source	National
Viamo	In Rwanda, Viamo is adapted to serve as a mobile phone training platform for CHWs on mental health. Through the platform, the Rwandan government has rapidly educated almost 60,000 CHWs using IVR for trainings. In Rwanda, Viamo has also been used to support the training of CHWs on Ebola preparedness and to send reminder messages to vaccination campaign participants. Viamo started a messaging campaign for 20,000 project beneficiaries through pre-recorded audio messages.	**Learning and training, risk communication and community engagement**	Grameen Foundation, Johnson & Johnson, UNICEF	EBODAC, Grameen Foundation, MOH, UNICEF, Viamo	Proprietary	National
VigiFlow	VigiFlow is a management system for recording, processing, and sharing reports of adverse effects for medical products. VigiFlow enables maximum local control and provides an effective means for management review and analysis of national data. VigiFlow has a medicines track and trace system that will ensure that all medical products and health technologies in the market have a tracing number.	**Laboratory systems, routine surveillance, supply chain**		Rwanda FDA, UMC	Open source	Subnational
WelTel	WelTel is an evidence-based, text messaging solution for improving patient adherence. The tool is used in many countries to support evidence-based integrated patient engagement, virtual care, communication outreach and data collection for COVID-19 and many other health areas (e.g., MNCH, TB, HIV, PrEP). The tool has been validated to impact positive behavior change to improve health outcomes and save lives. WelTel's system supports appointment scheduling and reminders, and broadcasts videos of public health information on a secure patient portal. WelTel is currently deployed for COVID-19 response in Rwanda, Uganda, Tanzania, and the United Kingdom. The platform is deployed on a national level in Rwanda at points of entry (e.g., airports) and EOCs. The tool is being used to track COVID-19 contacts and positive cases in a home-based care program.	**Case management, contact tracing, coordination and operations, diagnostic tools, event-based surveillance, health facility and provider administration, infection prevention and control, laboratory systems, points of entry, risk communication and community engagement, routine surveillance, vaccine delivery and planning**	Grand Challenges Canada, RBC, CIHR, Rwanda MOH/RBC, GCC	MOH, RBC, WelTel Inc., Government, MOH	Proprietary	National
World Continuing Education Alliance	This learning management system is a multifield eLearning and mHealth system that supports virtual and blended learning linked to certifications for professional development and lifelong learning. Examples of content include modules about nursing and midwifery and COVID-19 (both clinical and nonclinical). The platform generates reports on study habits and data of users (i.e., age, gender, location, qualification, role, employment status).	**Learning and training**		World Continuing Education Alliance	Proprietary	National
Zipline Drone Delivery Service	Zipline started a blood-delivery service in Rwanda in 2016 that uses drones to deliver medical products to remote, hard-to-reach areas in a matter of minutes, versus a matter of hours or days. Zipline now delivers two-fifths of the country's blood supply outside the capital, and it plans to scale to the rest of Rwanda.. For COVID-19, Zipline Drone Delivery has been used for delivery of medicines and other essential logistics.	**Infection prevention and control, supply chain, vaccine delivery and planning**	Gavi, MOH, UPS	MOH, Zipline	Public domain	Subnational
Babylon Health	Babylon Health operates a telemedicine service whereby patients dial a USSD short code *811# to book an appointment with a provider. The provider calls back to check the patient's symptoms, prescribe medicine, issue lab tests, etc. Babylon Health also operates a toll free call center for patients seeking support, advice and information.	**Case management, contact tracing, diagnostic tools**	Gates Foundation	Babylon, MOH	Proprietary	National

■ Digital tools deployed for COVID-19 response   ■ Opportunities to adapt tools for pandemic response

Table 2. An in-depth look at digital health tools to support the COVID-19 response, continued.

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
Cadasta platform	Cadasta provides a common global platform and set of technology and training tools that allow local organizations, government entities, and communities to document and map land and occupants in a more quick, efficient, and affordable way. Cadasta is based on an Esri-based suite of best-in-class tools and technologies that takes the land-related data and migrates the data into government systems.	**Routine surveillance**		Cadasta	Proprietary	
ColdTrace	ColdTrace is a wireless remote temperature monitoring solution designed for vaccine refrigerators in rural clinics and health facilities. The impact of COVID-19 on lifesaving immunization services has highlighted the need for a resilient cold chain system that can serve both routine and emergency vaccination going forward. This is possible by having end-to-end visibility into the country's vaccine cold chain network and ensuring data on fridge performance, power, and connectivity are available to the MOH in real time through ColdTrace. ColdTrace has partnerships with seven national governments and is active in 17 other countries. NexLeaf Analytics has connected cold chain equipment from over 16,822 health facilities and trained more than 1,400 health workers to respond to cold chain failures.	**Supply chain, vaccine delivery and planning**	Grand Challenges Canada	NexLeaf Analytics		
Computer-Aided Detection for Tuberculosis (CAD4TB)	CAD4TB is software designed to help non-experts detect and diagnose tuberculosis more accurately and cost-effectively using digital X-rays, machine learning, and remote expertise. This solution has been adapted in other countries to triage COVID-19 suspected cases and is able to use artificial intelligence on chest X-rays. The CAD4COVID is a free solution that supports triaging in resource-constrained settings and high-prevalence areas.	**Case management, diagnostic tools, event-based surveillance, infection prevention and control**		Delft Imaging	Proprietary	National
CyberRwanda	CyberRwanda is a digital platform that aims to improve the health and livelihoods of Rwandan adolescents (12 to 19 years). Co-designed by YLabs with Rwandan youth themselves, this digital Direct-to-Consumer platform weaves together Edutainment (educational entertainment) and knowledge-based content through a webcomic series and a robust FAQ library, with online pharmacy ordering and a health facility locator. Together, these components deliver integrated age-appropriate adolescent health and economic empowerment information, and linkage to youth-friendly services. CyberRwanda includes digital prototypes to assess provider knowledge on contraceptive methods through interactive games and simulated chat forums on how to provide youth services.	**Learning and training, risk communication and community engagement**	Packard Foundation, USAID	SFH, University of California at Berkeley School of Public Health, University of Rwanda School of Public Health, YLabs, Youth Tech Health		National
DataToCare	DataToCare is a suite of integrated applications that collects and disseminates diagnostic and surveillance data from remote laboratories to regional and national stakeholders. It allows medical teams access to the data for decision-making. The DataToCare desktop is installed across Rwanda in laboratories to collect and transfer diagnostic data and send via internet or SMS to the central server. The DataToCare server computes diagnostic or epidemiological data from points of care and remote laboratories. Data on the central server is used to create a dashboard that provides national/regional/provincial overviews of the data in real-time. DataToCare also allows notification of the test results to clients via SMS as soon as the tests results are available and validated by the operator.	**Case management, coordination and operations, event-based surveillance, laboratory systems, routine surveillance**		Savics, WHO	Open source	
East, Central, and Southern Africa (ECSA) TB Supply Chain Portal	ECSA TB Supply Chain Portal is an electronic platform that is used to capture, collate, and create reports to disseminate TB commodities' supply chain information including stock status, pipeline monitoring, and selected supply chain key performance indicators. The portal offers countries and regional bodies access to synthesized data with simple analysis for managers and decision-makers to inform actions. Supply chain information such as quantification, procurement, storage, inventory management, and quality assurance are gathered from existing LMIS systems without creating a new data collection system. The system enables regional information sharing and mitigates risk of stockouts, overstock, and expiries.	**Coordination and operations, supply chain**	USAID	ChallengeTB, MSH, USAID	Proprietary	
iHRIS	iHRIS is a free, open source software package that helps countries around the world track and manage their health workforce data to improve access to services. Countries use it to capture and maintain high-quality information for health workforce planning, management, regulation, and training.	**Health facility and provider administration, vaccine delivery and planning**		IntraHealth International, MOH	Open source	National

■ Digital tools deployed for COVID-19 response ■ Opportunities to adapt tools for pandemic response

Table 2. An in-depth look at digital health tools to support the COVID-19 response, continued.

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
Integrated Supportive Supervision (ISS)	ISS is an electronic checklist used for supervision during active case search and routine immunization.	**Case management, vaccine delivery and planning**			Open source	National
OpenMRS	OpenMRS is a software platform and a reference application that enables design of a customized medical records system. OpenMRS has adapted its software to make it easier for 5,500 existing implementations to screen, test, and manage patients (diagnostic tools) and to report data out efficiently to DHIS2 for public health surveillance.	**Case management, contact tracing, event-based surveillance, health facility and provider administration, routine surveillance, vaccine delivery and planning**		PIH (Inshuti Mu Buzima in Rwanda)	Open source	Subnational
Quantimed	Quantification of essential medicines and supplies. Quantimed is designed to improve the accuracy of order planning and budgeting by providing a systematic approach to organizing and analyzing data. Quantimed facilitates the calculation of commodity needs using either a single method or a combination of any of the three primary quantification methods: past consumption, morbidity patterns, and proxy consumption. Depending on the availability of data, Quantimed can be applied at the local level with one facility, the regional level with several facilities, or at the country level for a national control program.	**Supply chain**		MSH, USAID	Open source	
Reveal	Reveal is an open source platform that uses smart maps and technology appropriate for resource-constrained settings to monitor coverage of interventions in real-time. It is designed to optimize available resources. Reveal supports decision-makers by guiding and tracking delivery of field activities with precision and holding field teams accountable for action. Reveal has a mobile application that spatially guides field teams to planned areas and households for service delivery. This mobile application allows offline data collection and captures indicators to inform critical field decisions. Reveal also includes web user interface real-time dashboards to provide program managers with impactful coverage data to inform current activities and program progress.	**Vaccine delivery and planning**		Akros, EndFund, MOH	Open source	Subnational
U-Report	U-Report is a social messaging tool and data collection system to improve citizen engagement, inform leaders, and foster positive change. The program sends SMS polls and alerts to its participants, collecting real time responses, and subsequently publishes gathered data.	**Risk communication and community engagement, routine surveillance**	UNICEF	UNICEF	Open source	Subnational

■ Digital tools deployed for COVID-19 response   ■ Opportunities to adapt tools for pandemic response

"We need systems that support devices that often work offline, but that are able to connect online and synchronize to a centralized server."

—Rwanda Ministry of Health official, from key informant interview

At a glance

Figure 2 shows that Rwanda's digital health tools rely on different software licensing types for sustainability with open source being the most common. Figure 3 demonstrates that Rwanda has 23 digital health tools deployed on a national scale while 10 operate on a subnational scale. These figures are not specific to COVID-19 response, but they provide an overall picture of Rwanda's digital health infrastructure.

Figure 2. Software licensing types of Rwanda's digital health tools.

Public domain 2%
Freemium 2%
Unspecified 13%
Open source 54%
Proprietary 29%
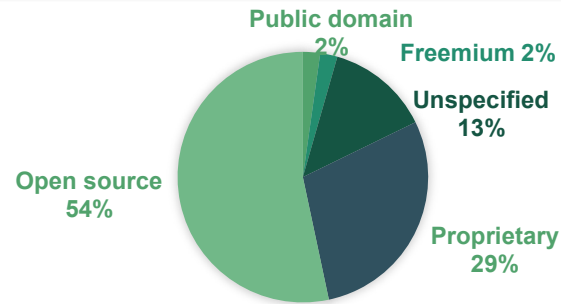
Figure 3. Number of digital tools deployed at scale in Rwanda.

23 National
10 Subnational
11 Unspecified
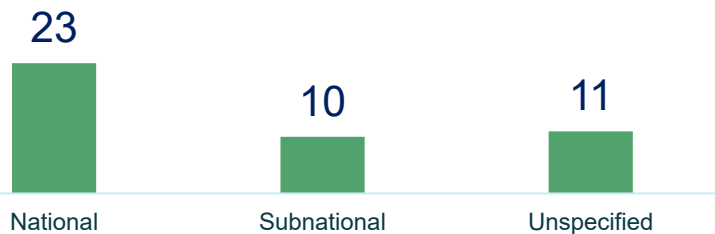
Conclusion

Digital Square mapped 44 existing, adaptable digital health tools in Rwanda and matched them to help target investments to accelerate the country's COVID-19 response and simultaneously strengthen its health system. This brief underpins how critical it is to align funding to Rwanda's existing digital health infrastructure to bolster its capacity to mitigate the effects of the current pandemic and prepare the country to respond to future outbreaks.

Take action

☑ **Coordinate with all digital systems stakeholders** to create a unified, robust digital health system that can strategically and rapidly be part of the ongoing COVID-19 response. It is paramount to support the government's lead and support its national digital health strategies and the tools it approves. Visit the Digital Health Atlas to see a complete, regularly updated snapshot of Rwanda's digital health system. If you know of a digital system that is not identified in this brief, please add it to the Digital Health Atlas.

☑ **Reuse existing tools when possible.** Do not invest in new systems if there are existing systems the government endorses that can effectively approach each of the pandemic use cases.

☑ **Learn more about Rwanda's digital health systems** and their role in the COVID-19 response by reviewing Rwanda's full Map and Match dataset.

☑ **Apply GIZ's Assessment Tool for Digital Pandemic Preparedness** to better understand the strengths and gaps in the country's COVID-19 response and to be well prepared for future disease outbreaks.

☑ **Connect with additional relevant resources, including:**

Digital Square continues to update its wiki with adaptations of Digital Square Global Goods and has a COVID-19 resource page that features hosted webinars that provide demos of tool adaptations.

The recently released Global Goods Guidebook (version 2.0) includes additional information about global goods deployment for COVID-19.

Map and Match's project landing page has many resources, including the Digital Applications and Tools Across an Epidemiological Curve, Global Goods Adaptations Across Use Cases, and other country briefs.

Digital Solutions for COVID-19 Response, published by Johns Hopkins University, features digital platforms that have been adapted for COVID-19 case management and contact tracing needs. The assessment includes a review of nine tools that were selected based on their existing deployment, flexibility, and adaptability for COVID-19 use cases; their ability to support multiple languages; and stakeholder interest in how these applications can be leveraged in response to COVID-19.

Annex 1. Abbreviations

Acronym	Definition
API	application programming interface
CARE	Cooperative for Assistance and Relief Everywhere
CDC	US Centers for Disease Control and Prevention
CHWs	community health workers
CRS	Catholic Relief Services
DAHW	German Leprosy & Tuberculosis Relief Association
EBODAC	Ebola Vaccine Deployment, Acceptance and Compliance
ECSA	East, Central, and Southern Africa
EMR	electronic medical record
FDA	Food and Drug Administration
GDHF	Global Humanitarian and Development Foundation
GHSC-PSM	USAID Global Health Supply Chain–Procurement and Supply Management
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HISP	Health Information Systems Programme
ICT	information communications technologies
IPA	Innovations for Poverty Action
IRH	Georgetown University's Institute for Reproductive Health
IVR	interactive voice response
MOH	Ministry of Health
MNOs	mobile network operators
MSH	Management Sciences for Health
MVG-Net	Millenium Village Project Global Network
Norad	Norwegian Agency for Development Cooperation
PIH	Partners in Health
RBC	Rwanda Biomedical Center
REST	The Refugee and Empowerment Support Taskforce
SaaS	software as a service

Acronym	Definition
SFH	Society for Family Health
SGO	Save Generations Organization
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
UPS	United Parcel Service
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data
WHO	World Health Organization

Annex 2. Use case definitions

Category	Objective	Functional description
Case management	Systematic processing of suspected infected persons	Systems for documenting patient details and clinical interactions
Contact tracing	Reduction of epidemic reproduction rate	Identification and follow-up with people who have had high-risk interactions with infected persons
Coordination and operations (including emergency operations centers)	Preparedness and response plans, support for multisectoral responses	Systems to support cross-coordination for multisectoral response, emergency operations centers, and executing response plans
Data analytics, visualizations, and use	Efficient and effective response to validated outbreaks	Systems for enabling data-driven decision-making and communications to field teams
Diagnostic tools	Improve efficiency in clinical diagnosis and collection of data from diagnostic tools	Diagnostic tools with digital connectivity to support monitoring, documentation, and reporting of diagnoses
Event-based surveillance (including rapid response teams, case investigations)	Early detection of outbreaks and epidemics, case detection and investigation, national and subnational emergency operations to ensure rapid management of infectious disease	Systems with functionality or ability to monitor patterns indicative of infectious disease epidemic outbreak; systems to detect and document cases of emerging disease threats, investigate those threats, identify cases, and manage the response
Health facility and provider administration	Robust organizational underpinning for response	Systems for managing facility accounting and HR
Infection prevention and control	Prevent infection among patients and health workers	Systems that support triage, isolation, WASH, waste management to prevent transmission to staff, other patients, and the community
Interoperability	Improve effectiveness of tools	Provision of standardized interfaces to other software modules
Laboratory systems	Validation of infectious disease incidence	Systems with functionality to order lab tests, follow progress of patient sample, receive test results (confirm suspected case)
Learning and training	Support health worker readiness, including improve patient data collection and sample testing	Localized E-learning solutions for health workers and others
One Health	Prevent zoonotic disease outbreaks	Monitoring of potential vectors to humans by tracking infectious diseases in local wildlife and livestock
Points of entry	Detect and manage international spread of disease by identifying suspected infected persons at border entry points	Systems to strengthen border health security, screen, and follow-up with suspected infected persons at ports of entry and other border entry points
Risk communication and community engagement	Improved public awareness of facts and best practices for disease prevention	Systems for channeling messaging and communication to public to promote public awareness, counter misinformation, encourage treatment seeking behaviors, and encourage citizens to take appropriate actions to promote health
Routine surveillance	Routine health data monitoring to identify trends	Systems to manage health data and track trends on an ongoing basis, regardless of whether there is an outbreak or epidemic; systems usually include aggregate data
Supply chain	Support allocation of resources to aid in response	Systems for monitoring facility readiness and stock levels
Vaccine delivery and planning	Systematic monitoring of vaccinations in the population	Systems for documenting vaccinations for patients

Annex 3. Digital tools supporting vaccine deployment

Digital technologies can act as accelerators for the introduction, deployment, and scale-up of vaccines in countries to assist health workers, communities, and other stakeholders. The use of digital tools and the data they enable facilitate rapid, iterative, and scalable approaches to ensure vaccines are safely delivered to health facilities, that health workers are equipped to administer them, and that communities are informed and confident in their efficacy.

Through the Map and Match project, Digital Square mapped the existing functionality of approved global goods to COVID-19 use cases, including those supporting planning, delivery, administration, and monitoring of COVID-19 vaccines. These adaptations and supporting resources are listed on Digital Square's wiki.

Table 3 illustrates how digital tools can support activities aligned to five use cases focused on vaccines. Digital Square has information about its approved global goods and how they align to these use cases currently as well as potential adaptations on its website. This list does not include all digital public goods in the digital health ecosystem. Other tools like RapidPro and WelTel, which are not supported through Digital Square, can be included in these use cases.

Table 3. Global goods tools to support vaccine deployment use cases.

Description of vaccine deployment use cases	Digital Square approved global goods use cases
Plan for vaccine introduction in country Digital tools can be used for planning and "microplanning" to inform how many vaccines are needed, where vaccines can be stored and monitored, who the most vulnerable populations are and where they are located, and other information essential to planning. Assessing the tools and data available throughout the health system, including patient data and health worker data, will inform this planning. As part of a vaccine introduction, governments need to build awareness of the vaccine and its benefits, and combat misinformation. Digital tools can be used for planning purposes to send messages to both health workers and communities about the vaccine. Training health workers is essential before introducing a new vaccine. Governments need to provide information to health workers on vaccine administration, possible side effects, and how to treat patients showing adverse reactions. Digital tools can be leveraged to rapidly share this information and offer virtual training.	**Messaging** **Microplanning** **Training**
Support vaccine introduction Digital tools can enhance the launching of a vaccination campaign. Communication tools like SMS and social media can support rapid information sharing with communities as the vaccine is made available. Pharmacies, hospitals, clinics, and other facilities use robust digital systems to ensure vaccines are stocked at facilities by tracking inventory and shelf life and ordering additional supplies when needed. Digital tools can manage the transactional movements of vaccines within multilevel supply chains. Supply chain systems can also ensure that syringes, diluents, and other materials needed for vaccine delivery are stocked. Digital tools can support temperature monitoring during transport and where vaccines are stored. Remote temperature monitoring can improve cold chain performance, giving health workers assurance that vaccines are safe and effective. Digital tools can track when clients receive vaccines as well as other data fields (e.g., vaccine type, immediate negative reactions, and longer-term potential adverse events). Countries can adapt existing electronic immunization registries (EIRs) for vaccine monitoring and follow-up.	**Patient monitoring** **Supply chain** **Vaccine management**

Digital Square approved global goods use cases

Electronic immunization registries
DHIS2 Tracker, OpenSRP, OpenMRS, Tamanu

Messaging
CommCare, Community Health Toolkit, mHero, OpenSRP

Microplanning
Healthsites, OpenSRP, Reveal

Patient monitoring
CommCare, DHIS2 Tracker, OpenSRP, SORMAS

Supply chain
DHIS2, OpenLMIS, Logistimo, OpenBoxes, Product Catalogue Management Tool

Training
CommCare, Community Health Toolkit, mHero, OpenSRP, SORMAS

Vaccine management
CommCare, Community Health Toolkit, DHIS2, DHIS2 Tracker, Logistimo, OpenBoxes, OpenLMIS, OpenSRP, Tamanu

Table 3. Global goods tools to support vaccine deployment use cases, continued.

Description of vaccine deployment use cases	Digital Square approved global goods use cases
Enhance roll-out of vaccine, support ongoing vaccine monitoring In this phase, scaling to vaccinate large portions of the population is a priority. Vaccine roll-outs can be enhanced by adapting digital tools to add workflows and functionality as vaccine coverage expands. Governments need to consider additional information communications technology (ICT) needs like larger cloud-hosting services and use of tools that are operational offline for areas that have limited mobile network coverage. Supply chain is critical as vaccines are transported to more sites across the country. Digital supply chain tools, especially when paired with vaccine delivery data (e.g., from electronic medical records/EIRs), can help forecast supply needs and include decision support to prompt vaccine orders when supply falls below a defined threshold. EIRs and other tools can help prevent overcrowding in clinics by scheduling specific clinic times for vaccines. This ensures more equitable distribution of health services.	📇 **EIRs** 🌐 **Supply chain** 📱 **Patient monitoring** 💉 **Vaccine management**
Enhance communication to sustain vaccine demand Many COVID-19 vaccines are multi-dose shots. To ensure clients receive boosters, now and in the future, enhancing communication to sustain demand for the vaccine is important. Digital tools can be used to send messages to both health workers and communities about the vaccine. Communication tools can be linked with patient monitoring tools to automatically trigger direct communication to clients. Digital tools can continue to be used to increase vaccine demand and address misinformation, dispelling rumors and misinformation that cause vaccine hesitancy. Many EIRs include contact information and messaging features for patients' caregivers, allowing for direct communication to caregivers. These messaging features have historically been used to notify caregivers about upcoming immunization sessions or overdue vaccines. As the global community develops a greater understanding of COVID-19—including its transmission patterns, full range of symptoms, and treatment options—health workers also have the ability to share health promotion messages with patients.	📇 **EIRs** 💬 **Messaging** 📱 **Patient monitoring**
Use data to inform vaccine-related decisions Patient monitoring and tracking tools as well as EIRs can help generate meaningful insights for future vaccination efforts and encourage data-driven decisions when countries are able to plan for catch-up campaigns. For example, some EIRs can quantify the number of missed vaccines and determine which areas have been under-vaccinated. This individual-level data will enable decision-makers to target immunization services and allocate funding to those areas most in need. For more information, this publication explains how Gavi and UNICEF are working to scale up use of digital tools for vaccination campaign performance monitoring. Interoperability is critical. As governments review the portfolio of tools and systems that are in place to support vaccine management, it is crucial that there is strong consideration given to the movement of data between systems to ensure a harmonized set of records for the population. This ensures that no individual is missed or counted twice.	📇 **EIRs** 📱 **Patient monitoring** 🌐 **Supply chain** 💉 **Vaccine management**

Digital Health Center of Excellence (DICE) to support the COVID-19 pandemic response

As countries operationalize their COVID-19 vaccine rollout plans, there is an opportunity to identify areas where digital health interventions can amplify these efforts, while improving service delivery and strengthening health systems more broadly.

The success of digital health solutions often correlates with the strength of the enabling environment for these technologies, such as ICT infrastructure readiness, workforce capacity, data standards, interoperability, and the policy and regulatory environment. Poorly designed or inappropriate digital interventions, as well as vertical approaches geared only toward COVID-19, risk undermining and ultimately weakening national systems.

To more effectively organize support to countries for COVID-19 response, a multiagency COVID-19 DICE, with a UNICEF-WHO cohosted secretariat, will launch in April 2021. The DICE will provide coordinated technical assistance to low- and middle-income countries to support sustainable and scalable deployment of carefully chosen digital health solutions that support COVID-19 pandemic response plans.

Areas the COVID-19 DICE covers include:

- Support countries to conduct a structural readiness assessment of their enabling environment, define business requirements, conduct platform analysis, and map partnerships, existing tools, and gaps. Along with support to countries, this will require standardizing approaches and tools across development partners.
- Coordinate surge support to countries to assist in their development of a rapid strategic approach to meet the imminent needs of the vaccine delivery and transition to a sustainable strengthened and digitally enabled health system.
- Foster capacity and partnership with regional and national digital health experts toward the development of capacity that can provide long-term technical support to the region.
- Strategically support developers and product owners to modify and optimize software products relevant for pandemic response and vaccine delivery toward interoperability, standardization, and vaccine-specific functionalities.
- Complement and operationalize WHO and UNICEF guidelines developed in the context of the Access to COVID-19 Tools Accelerator (ACT-A) to further clarify and identify mature options open to countries building health infrastructure.
- Support the transition, alignment, and integration of COVID-19-related digital health investments through a systems strengthening lens.
- Pilot and assess transformative approaches to digital health deployments, monitor global developments and opportunities for standardized approaches, increase south-south knowledge transfer, and compile lessons learned.