

Digital health systems to support pandemic response in Mozambique

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

April 2021

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Introduction

Mozambique's Ministry of Health (MISAU) will soon publish its next national health strategy to follow its *Plano Estratégico do Sector da Saúde: 2014–2019*. The new strategy document (currently in draft form) prioritizes the use of electronic reporting systems, quality of data, interoperability, and local capacity strengthening. The COVID-19 pandemic brought a new level of urgency to meeting these country-level priorities. Leveraging digital health tools is a rapid, cost-effective strategy to accelerate Mozambique's COVID-19 response while at the same time reinforcing health sector priorities.

Background

Digital Square conducted a landscape analysis of Mozambique's digital systems in the ten-year period from 2010–2020 with information validated by tool implementers and designers, digital health experts, and MISAU stakeholders as part of the USAID-funded Map and Match project. The purpose was to identify the existing digital tools utilized in Mozambique, 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.



Analysis overview

Map and Match's analysis found that Mozambique's health system utilizes 51 digital health tools with at least 17 already deployed for COVID-19 response. This brief identifies opportunities for existing digital tools to be adapted to pandemic use cases to respond to needs for the COVID-19 response and potential future epidemics. Mapping of the existing tools to the use cases revealed where there are strengths and opportunities in Mozambique's digital health systems' response to COVID-19. For example, the analysis identified only one tool that currently supports points of entry, with additional tools ready for adaptation to further address 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.

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.

Figure 1. Current number of digital health tool deployments mapped to pandemic use cases in Mozambique.

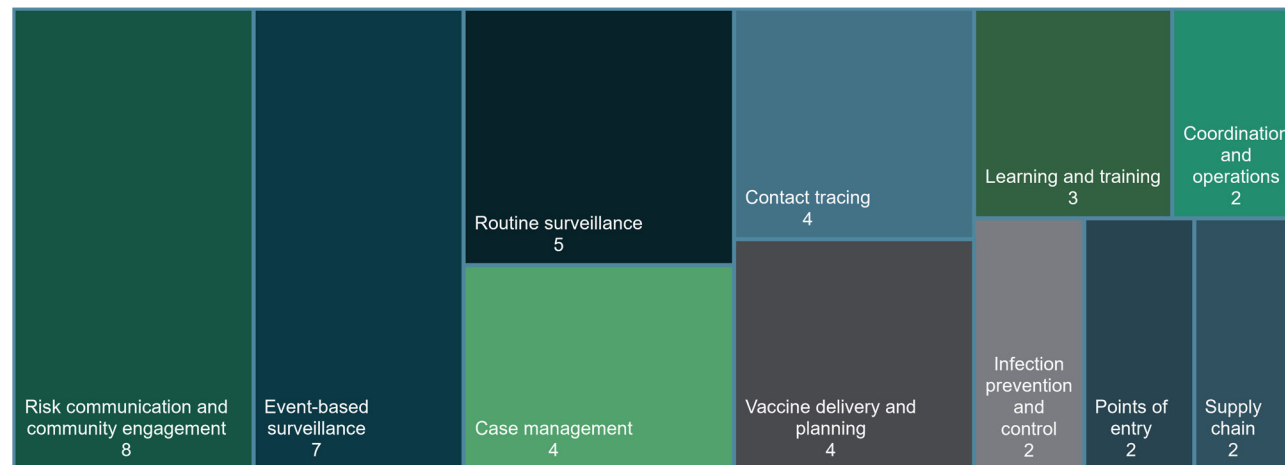


Figure 1 illustrates that many use cases are addressed using several tools in Mozambique's COVID-19 response while other use cases are filled by few tools.

Table 1. Mapping and matching digital health tools to strengthen Mozambique’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 Mozambique’s COVID-19 response. Digital Square matched opportunities for tool adaptation across the pandemic use cases in **green** to reveal places where Mozambique can reuse parts of its existing digital health systems to strengthen its COVID-19 response.

		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
DIGITAL HEALTH TOOLS	AlôVida hotline					Blue										
	ArcGIS Survey123		Green									Blue				
	Everwell Hub															
	HealthConnect											Blue				
	mAlert system			Blue		Blue		Blue								
	Mapbox			Blue												
	Mozambique HMIS (DHIS2 with Tracker)	Blue	Blue	Green	Green	Blue			Green		Green	Blue		Blue	Green	Blue
	Pensa		Green			Green						Green	Blue	Green		
	RapidPro												Blue			
	Safe Delivery App									Blue		Blue				
	SIGLUS					Green									Blue	Blue
	SIOS		Green			Blue						Green		Blue		
	SISMA	Blue	Blue	Green		Blue								Blue		Blue
	upSCALE APE app	Blue				Blue							Blue	Blue		
	U-Report												Blue			
	Viamo 3-2-1 Service		Blue							Blue			Blue			Green
	Zenysis Analytics Platform	Blue	Blue			Blue								Blue	Blue	Blue
	Akuko												Green			
	Bahmni	Green		Green	Green			Green							Green	

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

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

PANDEMIC USE CASES

DIGITAL HEALTH TOOLS	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
CAD4TB				■											
Cadasta platform			■												
CHAIN														■	
Community Scorecard App						■									
DisaLab								■							
ECSCA TB Supply Chain Portal			■											■	
Everwell Hub															
Facebook Messenger															
GxAlert				■	■			■				■			
Health Network Quality Improvement System (HNQIS)						■									
Integrated Supportive Supervision (SS)	■														■
Intra-Hospital Death Registration System (SIS-ROH)													■		
mNutrition									■			■			
mUzima for Health Providers	■	■		■	■										
OnImpact	■											■			
OpenMRS	■	■			■	■							■		■
Pharmacovigilance Monitoring System (PViMS)					■										■
PharmaDex			■											■	
Quantimed			■											■	
SELV			■											■	■

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

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

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		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
DIGITAL HEALTH TOOLS	SIFIn						■									
	Timed and Targeted mHealth application (mTTC)	■								■						
	Vantage			■												
	VigiFlow								■							
	WhatsApp												■			

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

“I would like sustainability and country-level technical capacity strengthening so that one day MISAU can fully maintain our electronic health information systems. There is a huge need to focus on building the sustainability of technical assistance support because currently the University of Oslo provides much of the technical support and there is not enough local capacity.

I advocate for an integrated system, so a system that integrates with DHIS2 is a huge benefit for us. It is still the priority for us. It would be difficult to manage if it does not integrate.”

—Dr. Helder Macul, Focal Point, Quality Improvement, MISAU

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

The analysis identified existing digital tools that can be adapted to support COVID-19 response for use case gaps. Use case gaps are defined as those which have fewer than two tools addressing them. Many of these tools also provide opportunities to streamline the COVID-19 response across a range of use cases. To learn more about the tools in the matrix below, please see Table 2 for more details to facilitate adaptations.

Diagnostic tools

Bahmni	Mozambique HMIS (DHIS2 with Tracker)
CAD4TB	mUzima for Health Providers
GxAlert	

Health facility and provider administration

Bahmni	OpenMRS
Community Scorecard App	SIFIn
Health Network Quality Improvement System (HNQIS)	

Laboratory systems

Bahmni	GxAlert
DisaLab	Mozambique HMIS (DHIS2 with Tracker)
VigiFlow	

One Health

Mozambique HMIS (DHIS2 with Tracker)

Examples of global goods deployed and ready for adaptation for COVID-19-response in Mozambique

Bahmni (OpenMRS)

Bahmni is an open source EMR and hospital information system developed in the global south to meet the needs of low-resource environments and is currently deployed in 50+ countries. Bahmni is a distribution of the OpenMRS medical record platform. It manages patient information in a flexible fashion throughout the care cycle, including registration, various points of care, investigations, laboratory orders and results management, picture archiving and communication systems, and billing.

Bahmni released a COVID-19 kit that uses an OpenMRS module initializer to install forms that capture travel history and contact tracing, enable patient screening, and track information on home quarantining. Nepal adapted Bahmni for COVID-19 response as a case management tool in government hospitals by creating a COVID-19 screening template and syncing data in near real time to dashboards.

Mozambique HMIS (DHIS2 with Tracker)

Mozambique'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.

6
PANDEMIC
USE CASES

0
USE CASES
UTILIZED

6
ADAPTATION
OPPORTUNITIES
IDENTIFIED

- Case management
- Coordination and operations
- Diagnostic tools
- Health facility and provider administration
- Laboratory systems
- Supply chain

11
PANDEMIC
USE CASES

6
USE CASES
UTILIZED

5
ADAPTATION
OPPORTUNITIES
IDENTIFIED

- Case management
- Contract tracing
- Coordination and operations
- Diagnostic tools
- Event-based surveillance
- Laboratory systems
- One Health
- Points of entry
- 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
AlôVida hotline	AlôVida is a telephone hotline that provides medical-related information to Mozambicans throughout the country. The AlôVida hotline adapted to more efficiently respond to the COVID-19 pandemic by adding more simultaneous hotline phone lines, introducing new software that efficiently directs calls to hotline workers, giving callers the new option to listen to pre-recorded messages on COVID-19, and collecting critical data on callers (e.g., demographics, location and COVID-19 symptoms).	Event-based surveillance, risk communication and community engagement	USAID	Foundation for Community Development, Johns Hopkins Center for Communication Programs, MISAU, Viamo, VillageReach		National
ArcGIS Survey123	Survey123 is used to capture reliable data from devices while either online or offline. During COVID-19, WHO introduced this new tool at points of entry to screen borders at airports in Mozambique.	Contact tracing, points of entry		WHO	Proprietary	National
Mozambique HMIS (DHIS2 with Tracker)	Mozambique's HMIS, built on DHIS2, aggregates health information collected across the country. DHIS2 collects individual data on diseases such as HIV and COVID-19. DHIS2 is also used to manage laboratory data. DHIS2 adapted by creating a COVID-19 digital data package to accelerate case detection, situation reporting, active surveillance and response in countries. The COVID-19 digital data package includes standard metadata aligned with the WHO's technical guidance on COVID-19 surveillance and has been adapted to local country context and language in this implementation.	Case management, contact tracing, coordination and operations, diagnostic tools, event-based surveillance, laboratory systems, One Health, points of entry, routine surveillance, supply chain, vaccine delivery and planning	DHIS2, GAVI, Global Fund, MISAU, Norad	HISP Saudigitus (Lusophone Africa), MISAU	Open source	National
Everwell Hub	The Everwell Hub platform covers the entire digital cascade of care and is the core digital infrastructure that officers, health workers, and patients use to support diagnosis, treatment success, and recovery from TB. The Everwell Hub supports a broad patient management ecosystem (i.e., mobile, web, SMS, IVR).			Everwell, Government of Mozambique	Open source	
Health Connect	Health Connect enables effective health communication with patients, health providers, and the health system at large. Health Connect has been adapted for COVID-19 to provide national messaging services on behalf of WHO and several other country governments on COVID-19-related information via individual modules such as Health Alert, Health Check, and Health Worker Alert.	Risk communication and community engagement	Grand Challenges Canada, UNICEF	Praekelt	Open source	National
mAlert system	mAlert is a "virtual control room" that integrates health surveillance data into a single platform, distilling data from health facilities and accommodation centers, disease monitoring/surveillance, and laboratory testing. The software creates a coherent picture of a disease outbreak, the health system's ability to respond, and the resources available. Mozambique has used mAlert during the COVID-19 pandemic to inform critical discussion and decisions. Mozambique adapted the mAlert system during cholera outbreaks to identify sources of water contamination, to secure cholera vaccines, and to determine the location of cholera vaccination sites.	Coordination and operations, event-based surveillance, infection prevention and control	GAVI	Mozambique National Institute of Health, Tanzania Ministry of Communications and Transport, Zenysis	Proprietary	National
Mapbox	Mapbox is a mapping platform for custom designed maps. Mapbox's application programming interfaces (APIs) and software development kits (SDKs) are building blocks to integrate location into any mobile or web application.	Coordination and operations		Health Alliance International, MISAU	Proprietary	Subnational
Pensa	Pensa is a multichannel, bidirectional mHealth platform that provides free, MISAU-approved health information to people with feature phones and limited access to internet. Any user, on any network, on any phone can access it for free by dialing *660# and will be immediately presented with information on diseases, maternal and child health, ongoing health crises, and locations of nearby health facilities. Pensa can also allow users to respond to surveys, submit questions, and receive vital SMS campaigns.	Contact tracing, event-based surveillance, points of entry, risk communication and community engagement, routine surveillance	COVIDaction, Elevate Prize Fund, MIT Solve Challenge, National Innovation Fund (Fundo Nacional de Investigação)	MISAU, Pensa, Source Code	Public domain	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	UNICEF	MISAU, UNICEF	Open source	Subnational

 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
Safe Delivery App	The Safe Delivery App supports skilled birth attendants to quickly diagnose issues in pregnancy and with newborns, offering step-by-step guidelines to perform a treatment. It is free to download and can be preinstalled so that providers can watch the animated instruction videos and read the action cards and drug lists whether or not they have Wi-Fi. The Safe Delivery App includes the adaptation of a COVID-19 content module that provides skilled birth attendants (e.g., midwives) with key information, animated video instructions, and checklists to support them to limit the spread of COVID-19 in the health facilities, including information on infection prevention, breastfeeding, and vertical transmission.	Learning and training, infection prevention and control, risk communication and community engagement	Gates Foundation, ICM, Laerdal Global Health, Maternity Foundation, Merck for Mothers, UNFPA, University of Copenhagen	Denmark's Maternity Foundation, Maternity Foundation, Merck for Mothers, University of Copenhagen, University of Southern Denmark	Open source	National
SIGLUS (Sistema de Informação de Gestão Logística das Unidades Sanitárias) (OpenLMIS)	OpenLMIS is a powerful open source, cloud-based electronic logistics management information system (LMIS) purpose-built to manage health commodity supply chains. OpenLMIS manages the electronic LMIS process at more than 11,000 health facilities in nine African countries across all major health programs, including vaccines and COVID-19. OpenLMIS adapted its tool so countries can optimize their use of the software to encourage good supply chain management of COVID-19 supplies. OpenLMIS launched a separate, simplified instance called OpenLMIS COVID-19 Edition, which is a lighter-weight and quicker startup tool to help countries manage COVID-19-related commodities based on the WHO product list.	Event-based surveillance, supply chain, vaccine delivery and planning	Gates Foundation, USAID	USAID GHSC-PSM	Open source	National
SIOS (DHIS2 Tracker)	SIOS is a surveillance system designed to capture COVID-19 data, specifically patient hospitalizations and treatment. This tool is based on the DHIS2 Tracker platform adapted for COVID-19.	Contact tracing, event-based surveillance, points of entry, routine surveillance	CDC	Ins	Open source	Subnational
SISMA (O Sistema de Informação de Saúde de Moçambique para Monitoria e Avaliação) (DHIS2)	SISMA enables data collection from the district and health facility levels. SISMA visualizes aggregate data. SISMA is currently used for vaccine data collection in all districts and installed in 133 health facilities.	Case management, contact tracing, coordination and operations, event-based surveillance, routine surveillance, vaccine delivery and planning	CDC, DHIS2, The Global Fund, MISAU	MISAU, University of Oslo	Open source	Subnational
U-Report	U-Report is an mHealth application developed to provide real-time mobile counseling and conducting of coordinated polls among adolescents and young people. U-Report has been adapted to support COVID-19 in Mozambique by deploying a U-Report Information chatbot to support COVID-19 risk communication and community engagement.	Risk communication and community engagement	UNICEF	UNICEF	Open source	National
upSCALE APE (CommCare)	The upSCALE system, built on the CommCare platform, is composed of two case management applications, custom indicator dashboards, SMS notifications, and data integration with DHIS2. upSCALE is a mobile-based job aid for community health workers that incorporates many health areas, including family planning and antenatal and postnatal health services for its communities. upSCALE strengthens case management within communities by diagnosing, treating, and referring children with key childhood illnesses. Early childhood development content has been integrated into UpSCALE's patient-focused decision tree, including monitoring of child development milestones and counseling on age-appropriate stimulation activities.	Case management, event-based surveillance, learning and training, risk communication and community engagement, routine surveillance	FCDO, Malaria Consortium, UNICEF, USAID	Malaria Consortium, MISAU, PATH, UNICEF	Open source	National
Viamo 3-2-1 Service	Viamo leverages existing mobile infrastructure and local partnerships to provide mobile solutions that can be scaled nationally within weeks to effectively respond to rapidly evolving health emergencies such as COVID-19. Viamo exists to share critical information on prevention and treatment, curb panic, and correct rapidly spreading misinformation regarding the outbreak. Existing technology integrations in-country can be used to reach any mobile subscriber on any network to disseminate crucial information in targeted regions and to vulnerable populations. Viamo includes many COVID-19 services, including national and regional awareness campaigns, mobile surveys, social media chatbots, a COVID-19 case reporting hotline, a COVID-19 support call center, outbreak mapping and data visualizations, and remote training for health workers. Viamo is being used to share content on COVID-19 in the Remote Training for Frontline Health Workers tool, a free training that uses IVR to send training content to frontline health workers (based in the community or facility) through Viamo's platform. The prerecorded training modules are sent to each learner; the learner listens to the message, fills out an assessment after each module, and then receives a confirmation of completion and pre-SMS for the next module. The modules are sent to any type of phone to reduce access limitations. This is currently being used for content on COVID-19 and can be expanded to other health topics.	Contact tracing, learning and training, risk communication and community engagement, vaccine delivery and planning	Focusing Philanthropy	MISAU, Viamo, VillageReach	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
Zenysis Analytics Platform	The Zenysis Analytics Platform is a commercial-off-the-shelf data integration and advanced analytics platform used by national and state public health entities in 10 countries across three continents to enable data-driven emergency response activities, as well as routine program and resource management.	Case management, contact tracing, event-based surveillance, routine surveillance, supply chain, vaccine delivery and planning	The Global Fund	Zenysis	Proprietary	National
Akuko (Power BI)	Akuko is a digital data storytelling platform based on the Power BI platform that makes it easy to combine maps, charts, tables, narrative text, and images to provide compelling, context-rich stories with data.	Risk communication and community engagement	UNICEF		Open source	
Bahmni (OpenMRS)	Bahmni is an easy-to-use EMR and hospital information system. Bahmni is a distribution of the OpenMRS medical record platform, with a user interface built from the ground up. It also supports Odoo (formerly OpenERP), OpenELIS, and dcm4chee, providing an integrated, robust solution that manages patient information in a flexible fashion throughout the care cycle. Per MISAU interview, CDC provided funding to use Bahmni as a case management system specific to HIV patients, though it is not currently operational. MISAU communicated that Bahmni is a user-friendly system that could be adapted to expand beyond HIV to manage COVID-19 cases and other diseases.	Case management, coordination and operations, diagnostic tools, health facility and provider administration, laboratory systems, supply chain	CDC, PEPFAR	Jembi Health Systems, Satvix Informatics	Open source	Subnational
CAD4TB	Computer-Aided Detection for Tuberculosis (CAD4TB) is software designed to help non-experts detect and diagnose TB 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.	Diagnostic tools		Delft Imaging	Proprietary	
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.	Coordination and operations	Omidyar Network, UKaid	iTC-F	Proprietary	Subnational
CHAIN	Connected Health AI Network (CHAIN) uses AI to support the supply chain. CHAIN is enterprise software that learns and builds the predictive supply chain for health from the ground up. CHAIN makes it possible for existing resources to serve more people in need, unlocking capacity and increasing access to care.	Supply chain	Gates Foundation	Macro-eyes, MISAU, PATH, VillageReach	Proprietary	
Community Scorecard App	Community scorecards are widely used to build a trusted and constructive relationship between communities and health facility staff. The Community Scorecard App helps staff or volunteers running community scorecards to digitize and analyze the data generated from this process. The app includes three related tools: a simplified data entry app that is designed to work offline, a program management app that includes real-time analysis tools, and a data hub to aggregate and visualize data.	Health facility and provider administration	N'weti	Kwantu, N'weti	Open source	Subnational
DisaLab (OpenMRS)	DisaLab is the most widely scaled supply chain system in Mozambique. DisaLab includes a basic laboratory module for test requisitions, provides workflow and workload management, and allows for result entry and review. Data entry staff use DisaLink systems operations to enter results into OpenMRS, making the results available to providers to properly inform and guide clinical care decisions for their patients. DisaLab is currently used by laboratories in 12 countries. It adapts easily to local requirements and has the ability for users to work and report in multiple languages.	Laboratory systems	CDC, HHS, PEPFAR	DPS-Z, Friends in Global Health, PEPFAR	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
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	Subnational
EPTS (OpenMRS)	EPTS (Electronic Patient Tracking System) is built on OpenMRS to enable a customized medical records system. OpenMRS adapted its software to make it easier for 5,500 existing implementations to screen, test, and manage patients using diagnostic tools, and to report data out efficiently to DHIS2 for public health surveillance. In Mozambique, the EPTS retroactively aggregates and collects patient and case management data.	Case management, contact tracing, event-based surveillance, health facility and provider administration, routine surveillance, vaccine delivery and planning	CDC, PEPFAR, USAID	eSaúde, mOASIS	Open source	Subnational
Facebook Messenger	Facebook Messenger is a messaging app and platform developed by US-based Facebook, Inc.	Risk communication and community engagement			Proprietary	National
GxAlert	GxAlert is a digital open source platform that facilitates country-level surveillance by allowing data to flow across the health system. It includes a system for data management designed to work with any diagnostic device that can connect to the internet or a mobile network. For example, GxAlert can connect to electronic tuberculosis (eTB) managers and M&E systems. GxAlert can also send targeted SMS alerts to facility managers, health officers, and suppliers. GxAlert is implemented in MISAU sites, and the tool collects and transmits electronic diagnostic and operational data directly from diagnostic instruments.	Diagnostic tools, event-based surveillance, laboratory systems	TB REACH	Health Alliance International, NTP, SystemOne	Proprietary	National
Health Network Quality Improvement System (HNQIS)	The HNQIS is an electronic tablet-based application used to improve quality of health services and effectively achieve health impact at scale. The HNQIS app efficiently allocates resources dedicated to supervision visits within health care networks where and when they are needed most. HNQIS is an interactive tool composed of four modules designed to help quality assurance officers by (1) planning their supervision visits to providers, (2) assessing providers' performance in service provision, (3) improving providers' knowledge and skills, and (4) monitoring providers' performance over time.	Health facility and provider administration	FCDO, USAID	PSI	Open source	Subnational
Intra-Hospital Death Registration System (SIS-ROH)	The SIS-ROH supports Mozambique's national vital statistics by improving the coverage and the quality of the national mortality system.	Routine surveillance	PEPFAR	Jembi Health Systems, mOASIS, MRC	Open source	National
Integrated supportive supervision (ISS) (ODK)	ISS is an electronic checklist used for supervision during the active case search and routine immunization.	Case management, vaccine delivery and planning	WHO		Open source	National
mNutrition	mNutrition is an open source tool with nutrition and MNCH mobile-ready content for Mozambique available in Portuguese, Changana, Makwa, and English. In-country specialists produced all content based on recommended MNCH and local nutrition practices. MISAU played a vital role in the development and content validation. The content is available in various forms, including topic-specific fact sheets, SMSs, and voice message transcripts.	Learning and training, risk communication and community engagement	FCDO	GSMA, MISAU, PSI, Viamo, Vodacom	Open source	National
mTTC app (CommCare)	mTTC app is used by CHWs conducting TTC home visits to communicate and track health practices for MNCH at the household level. The mTTC app is built in CommCare, allowing easy adaptation and alignment to national data systems. The app collects real-time household-level data, which can easily be assimilated and used in data-based feedback and supervision. The app ensures that CHWs time home visits correctly by gestation/age of child, sending reminders on missed visits and follow-up, and improving workload management. The app includes audio-visuale with multiple language settings, and press-play messages to give accurate information to caregivers. CHWs are prompted to conduct post-referral assessment of care, including essential newborn care practices, stockouts, and case handling.	Case management, learning and training	Irish Aid, USAID, World Vision	MISAU, World Vision	Open source	Subnational

 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 (OpenMRS)	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.	Case management, contact tracing, diagnostic tools, event-based surveillance	USAID		Open source	National
OneImpact	The OneImpact project in Gaza is a TB community monitoring program aiming to make TB response more equitable, rights-based, and patient-centered. The platform gives TB patients a voice to express their concerns about the accessibility, acceptability, availability, and quality of TB services.	Case management, risk communication and community engagement	Stop TB Partnership	ADPP Mozambique, AMIMO, PNCT		
Pharmacovigilance Monitoring System (PViMS)	PViMS is used to track pharmacovigilance of medicines and vaccines with active surveillance and cohort monitoring, with a module for spontaneous reporting. It uses E2B, the international standard for the transmittal of electronic safety data, to make the data interoperable with WHO-Uppsala Monitoring Center. This tool is currently deployed in Mozambique, Philippines, and Rwanda. PViMS also has planned and funded deployments in Bangladesh and Nepal.	Event-based surveillance, vaccine delivery and planning	USAID	MISAU, MSH	Open source	National
Pharmadex	Pharmadex supports medicines' registrations workflows to issue marketing authorizations and registration for pharmaceutical products, facilitate post-market inspection, and import permits/licensing.	Coordination and operations, supply chain	USAID	MSH, SIAPS, USAID	Open source	National
Quantimed	Quantimed is a tool that quantifies 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.	Coordination and operations, supply chain	USAID	MSH, USAID	Open source	National
SELV (Sistema Electrónico de Logística de Vacinas) (OpenLMIS)	SELV is the name of Mozambique's customized implementation of OpenLMIS for vaccine management. OpenLMIS is a powerful open source, cloud-based electronic logistics management information system (LMIS) purpose-built to manage health commodity supply chains. It interoperates with warehouse management systems and enterprise resource planning solutions used at distribution centers. SELV is also interoperable with EMR systems and e-registers used at health facilities. The next phases of the SELV program is to fully integrate with its medical commodity supply chain counterpart, SIGLUS.	Coordination and operations, supply chain, vaccine delivery and planning	Gates Foundation, GAVI, USAID	CHAI, GHSC-PSM, MISAU, SolDevelo, Thoughtworks, Inc., VillageReach	Open source	National
SIFIn (Sistema de Informação para Formação Inicial)	MISAU established a network of 18 HTIs. These HTIs provide middle-level specialty training in the areas of general and maternal and child health, nursing, pharmacy, clinical laboratory, ophthalmology, orthopedics and physiotherapy, nutrition, general medicine, psychiatry, instrumentation, preventive medicine, and others. MISAU developed SIFIn (Information System for Sistema Initial Training) as an information system for these HTIs to serve two purposes: (1) to act as an academic registrar and (2) to guide and organize student and faculty management at the local level of each training institution.	Health facility and provider administration	CDC, Jhpiego, PEPFAR	ANEP, HTIs, INAGE, MISAU	Open source, public domain	National
Vantage	Vantage is an AI-enabled cloud platform that empowers health care workers to make decisions. The cloud-based platform is able to instantaneously analyze data and communicate findings and direct meaningful actions through automatically generated dashboards and targeted push notifications.	Coordination and operations		BroadReach	Proprietary	
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.	Laboratory systems	WHO		Open source	Subnational
WhatsApp	WhatsApp Messenger, or simply WhatsApp, is a freeware, cross-platform centralized messaging and voice-over-IP service owned by the US company Facebook, Inc. It allows users to send text messages and voice messages, make voice and video calls, and share images, documents, user locations, and other content.	Risk communication and community engagement				

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

At a glance

Figure 2 shows that Mozambique's digital health tools rely on different software licensing types for sustainability, with open source being the most common. Figure 3 demonstrates that Mozambique has 31 digital health tools deployed on a national scale while 14 operate on a subnational scale. These figures are not specific to COVID-19 response, but they provide an overall picture of Mozambique's digital health infrastructure.

Figure 2. Software licensing types of Mozambique's digital health

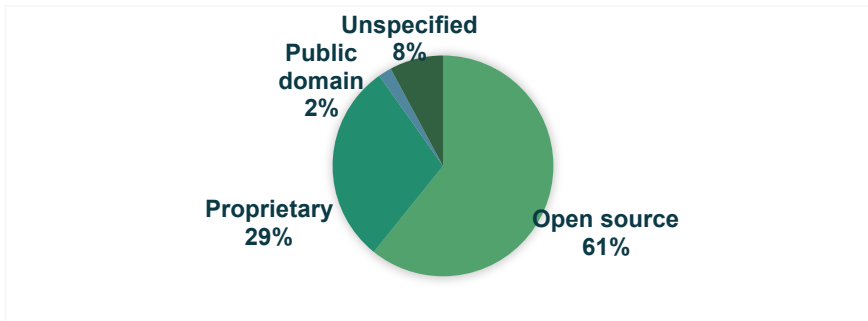
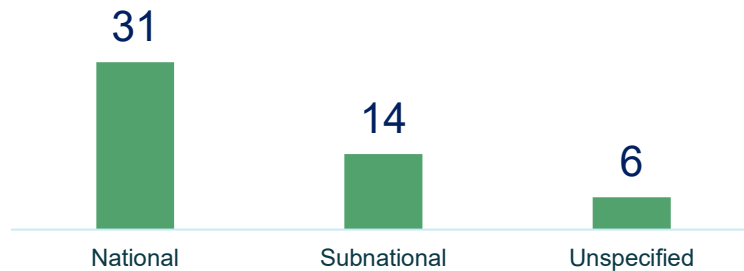






Figure 3. Number of digital tools deployed at scale in Mozambique.



Conclusion

Digital Square mapped 51 existing, adaptable digital health tools in Mozambique and matched them to help target investments to accelerate the country's COVID-19 response and simultaneously strengthen its health system. The analysis revealed many opportunities for the country to adapt and scale existing tools to aid in the pandemic response. This brief underpins how critical it is to align funding to Mozambique'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 Mozambique'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 Mozambique's digital health systems and their role in the COVID-19 response by reviewing Mozambique'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 includes additional information about global goods deployment for COVID-19.

Map and Match has many resources on its [project landing page](#) 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.



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Annex 1. Abbreviations

Acronym	Definition
ADPP	Development Aid from People for People
AI	artificial intelligence
AMIMO	The Association of Mozambican Mineworkers
ANEP	National Authority for Professional Education
CDC	US Centers for Disease Control and Prevention
CDM	CEPAC Dynamic Model
CHAI	Clinton Health Access Initiative
CHWs	community health workers
DHIS2	District Health Information System 2
DPS-Z	Provincial Directorate of Health of Zambézia
EIR	electronic immunization registry
EMR	electronic medical record
ESCA	East, Southern, Central Africa
FCDO	UK Foreign, Commonwealth & Development Office
GHSC-PSM	USAID Global Health Supply Chain–Procurement and Supply Management
GSMA	Global System for Mobile Communications
HHS	U.S. Department of Health and Human Services
HISP	Health Information Systems Programme
HTI	health training institution
HTS	HIV testing services
ICM	International Confederation of Midwives
INAGE Government)	Instituto Nacional de Governo Electrónico (National Institute of Electronic Government)
INS	Instituto Nacional de Saúde (National Institute of Health)
IP	intellectual property
iTC-F Foundation)	Fundação Iniciativa para Terras Comunitárias (Community Land Initiative Foundation)
IVR	interactive voice response

Acronym	Definition
M&E	monitoring and evaluation
MISAU	Ministry of Health
MNCH	maternal, newborn, and child health
mOASIS	Mozambican Open Architecture Standards and Information Systems
MRC	African Medical Research Council
MSH	Management Sciences for Health
Norad	The Norwegian Agency for Development Cooperation
NTP	National Tuberculosis Programme
Pensa Platform	Plataforma Educativa de Informação sobre a Saúde/Educational Health Information Platform
PEPFAR	US President’s Emergency Plan for AIDS Relief
PNCT	National Program to Combat Tuberculosis
PSI	Population Services International
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
SMS	short messaging service
TB	tuberculosis
TTC	timed and targeting counseling
UNFPA	United Nations Population Fund
UNICEF	United Nations Children’s Fund
USAID	United States Agency for International Development
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
<p>Plan for vaccine introduction in country</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p> Messaging</p> <p> Microplanning</p> <p> Training</p>
<p>Support vaccine introduction</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p> Patient monitoring</p> <p> Supply chain</p> <p> Vaccine management</p>

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
<p>Enhance roll-out of vaccine, support ongoing vaccine monitoring</p> <p>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.</p> <p>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.</p> <p>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.</p>	<ul style="list-style-type: none">  EIRs  Supply chain  Patient monitoring  Vaccine management
<p>Enhance communication to sustain vaccine demand</p> <p>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.</p> <p>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.</p>	<ul style="list-style-type: none">  EIRs  Messaging  Patient monitoring
<p>Use data to inform vaccine-related decisions</p> <p>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.</p> <p>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.</p>	<ul style="list-style-type: none">  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.