



Digital health systems to support pandemic response in Benin

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

May 2021

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Introduction

Benin's Ministry of Health (MOH) states its vision in its Stratégie Nationale de Cybersanté: 2018–2022 that by 2022, the Beninese health system will provide better health care for all its citizens by removing barriers of quality, equity, accessibility, and speed through the efficient use of eHealth. The COVID-19 pandemic has strained the health system, bringing a new level of urgency to the government's vision. Leveraging digital health tools is a rapid, cost-effective strategy to accelerate Benin's COVID-19 response while at the same time strengthening the health system at large.

Background

Digital Square conducted a landscape analysis of Benin's digital systems in the ten-year period from 2010–2020 with information validated by tool implementers and designers and digital health experts, as part of the US Agency for International Development (USAID)–funded Map and Match project. The purpose was to identify the existing digital tools used in Benin, 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 Benin's health system uses 30 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 Benin's digital health system's response to COVID-19. For example, the analysis identified only one tool that currently supports five use cases, with additional tools ready for adaptation to further address them. The analysis identified four use cases that have no tools currently fulfilling the functions, rendering them complete use case gaps. Moreover, the analysis detected 12 opportunities where District Health Information Software 2 (DHIS2) can be adapted to support COVID-19 response, including aiding vaccine deployment and monitoring. 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 Benin.

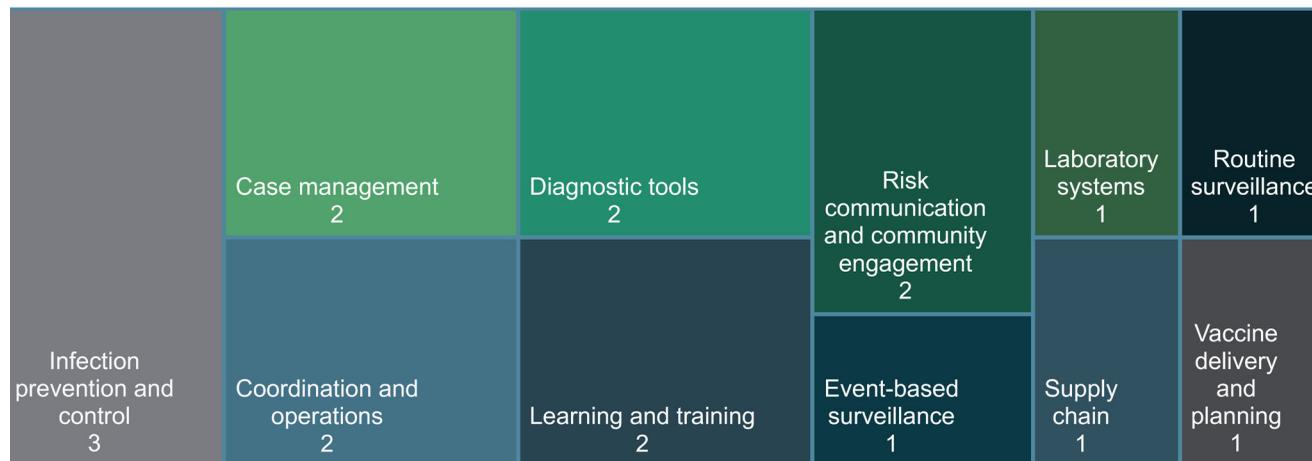


Figure 1 illustrates that many use cases are addressed using several tools in Benin's COVID-19 response while other use cases are filled by a sole tool.

Digital Square and USAID attempted outreach efforts to the MOH to conduct a key informant interview to validate the data found in the Map and Match assessment, but were unsuccessful.

Table 1. Mapping and matching digital health tools to strengthen Benin’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 Benin’s COVID-19 response. Digital Square matched opportunities for tool adaptation across the pandemic use cases in **green** to reveal places where Benin 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	Cash and Asset Transfer Platform (CAT)															
	COVID-19 Triage Tool															
	DataToCare															
	Kea Medicals															
	Réseautez entre médecins d’Afrique (REMA)															
	Safe Delivery App															
	SIIL (Système Informatisé d’Information Logistique/electronic Logistics Information System) (OpenLMIS)															
	Advancing Newborn, Child and Reproductive Health (ANCRE) / Alfia Comm (CommCare)															
	Benin HMIS (DHIS2)															
	Extract, Transform, Load (ETL) Application (DHIS2)															
	iHRIS															
	Logistics Data Visualization System (LDVS)															
	Logivac+ (OpenLMIS)															
	U-Report															
	VaxTrac (CommCare)															
	VigiFlow															
	Zenysis															

 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 analysis identified existing digital tools that can be adapted to support COVID-19 response for several use case gaps below. Use case gaps are defined as use cases that have fewer than two tools addressing them. Map and Match’s analysis found existing digital tools ready for adaptation to fulfill the nine use case gaps specific to Benin. 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. 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	
ANCRE / Alfia Comm (CommCare)	Benin HMIS (DHIS2)
Benin HMIS (DHIS2)	
Event-based surveillance	
DataToCare	ANCRE / Alfia Comm (CommCare)
Benin HMIS (DHIS2)	Zenysis
Health facility and provider administration	
ANCRE / Alfia Comm (CommCare)	Benin HMIS (DHIS2)
iHRIS	
Laboratory systems	
DataToCare	ANCRE / Alfia Comm (CommCare)
Benin HMIS (DHIS2)	
One Health	
Extract, Transform, Load (ETL) Application (DHIS2)	

Points of entry	
ANCRE / Alfia Comm (CommCare)	Benin HMIS (DHIS2)
Routine surveillance	
DataToCare	Benin HMIS (DHIS2)
Zenysis	
Supply chain	
SIIL (Système Informatisé d’Information Logistique) (OpenLMIS)	Benin HMIS (DHIS2)
Logistics Data Visualization System (LDVS)	Logivac+ (OpenLMIS)
VigiFlow	Zenysis
Vaccine delivery and planning	
SIIL (Système Informatisé d’Information Logistique) (OpenLMIS)	Benin HMIS (DHIS2)
iHRIS	Logivac+ (OpenLMIS)
VaxTrac (CommCare)	Zenysis

Example of a global good ready for adaption for COVID-19 response in Benin

DHIS2

Benin’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

0
USE CASES
UTILIZED

12
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
Cash and Asset Transfer Platform (CAT)	The platform tracks distribution of LLINs and sends messages to households on COVID-19 prevention and the importance of using LLINs for the safety and health of the household. Using a digital mapping dashboard and the CAT platform, MOH local managers can remotely supervise ITN distributions and conduct virtual daily review meetings to troubleshoot problems. CAT uses satellite imagery mapping of every building in Benin to pinpoint whether or not specific households received their ITNs. With geographic data, CAT provides a simple, user-friendly dashboard so MOH supervisors and other stakeholders can easily track distribution and ensure complete coverage.	Infection prevention and control, risk communication and community engagement		CRS, MOH	Open source	National
COVID-19 Triage Tool	Wellvis COVID-19 Triage Tool is an application that allows users to self-assess their COVID-19 risk category based on their symptoms and exposure history. It is free to users. The application also allows digital health care appointments that can be paid online.	Case management, diagnostic tools, infection prevention and control, risk communication and community engagement	Wellvis	Wellvis	Proprietary	
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 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.	Coordination and operations, event-based surveillance, laboratory systems, routine surveillance	StopTB Partnership	Benin NTP, Savics, WHO		National
Kea Medicals	Kea Medicals is a social enterprise based in Benin. Its hospital information system aims to interconnect health structures through a single database to facilitate the reporting of patients' medical histories. This interconnection is made possible thanks to the universal medical identification system of patients. During COVID-19, Kea Medicals has facilitated more than 25,000 remote, mobile-enabled doctor consultations per month on average via its telemedicine platform and launched a COVID-19 self-diagnosis tool in Benin. Its platform has more than 24,000 users and numerous health professionals in Benin, and there are plans to expand the solution to Côte d'Ivoire, Gabon, and Mali. Kea Medicals is part of the Taskforce Innov COVID-19 Benin.	Case management, coordination and operations, diagnostic tools		Kea Medicals	Proprietary	
Réseautez entre médecins d'Afrique (REMA)	Medical errors are costly in countries with fragile health systems. To reduce the probability of medical error, REMA launched an app that connects medical students, general practitioners, specialists and physicians in Benin to enable collaboration and support better decision-making. By democratizing the delivery of medical knowledge, REMA's solution helps doctors and medical students in Africa learn and improve their skills. Launched in 2017, REMA has a community of 6,000 health specialists based in West Africa who can discuss, resolve patient cases, and collaborate in real time to save more lives. REMA is part of the Taskforce Innov COVID-19 Benin.	Case management, learning and training	Rema Inc.	Rema Inc.		
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■ 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 is a free, evidence-based mobile application that uses simple, intuitive animated instruction videos, drug lists, and quizzes to guide health workers about how to handle the most common childbirth emergencies. The Safe Delivery App has been adapted with a module to help equip midwives in low-resource settings with up-to-date information to protect themselves, mothers, and newborns from COVID-19 and to ensure that women continue to receive quality services during pregnancy and childbirth. Following the successful pilot of the Safe Delivery App French Global version as a job aid with 15 health champion trainers and 100 health workers, the Safe Delivery App is used as a preservice training tool with midwifery trainers and students in the two national midwifery schools. The job aid pilot concluded in January 2018 with significant increase in knowledge and confidence of the included health workers. This tool is currently being adapted to a Benin-specific version, which adheres to national guidelines and directives. This will include the COVID-19 module.	Supply chain, vaccine delivery and planning	Gavi, UNICEF, Gates Foundation	MOH, VillageReach	Open source	Subnational
SIIL (Système Informatisé d'Information Logistique/ electronic Logistics Information System) (OpenLMIS)	SIIL facilitates electronic data collection. SIIL is a locally customized variant of the OpenLMIS free software developed by a partnership of organizations working internationally to address logistical challenges. OpenLMIS is a powerful, open source, cloud-based electronic 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-related 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.	Case management, contact tracing, event-based surveillance, health facility and provider administration, infection prevention control, laboratory systems, learning and training, points of entry, risk communication and community engagement	USAID	CRS, Dimagi, MOH, MSH	Open source	National
Advancing Newborn, Child and Reproductive Health (ANCRE)/AlafiaComm (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, uses simple device deployment, and includes translation features. This deployment of the CommCare app for the ANCRE program in Benin supported integrated community case management of childhood illness, Ebola contact tracing, stock management, and family planning until 2018. More than 5,000 children were registered and treated, and more than 2,000 family planning counseling sessions were completed (in eight local languages) using the mobile application. Data collected from CommCare is accessible and visible through a couple of dashboards, and the team is currently completing a test of DHIS2 integration, which will make selected indicators from CommCare data visible at the central level. CommCare is being further adapted to incorporate additional community-level malaria services to the application in a deployment called AlafiaComm. In other countries, CommCare is used across many use cases for COVID-19 response.	Case management, coordination and operations, contact tracing, diagnostic tools, event-based surveillance, health facility and provider administration, points of entry, laboratory systems, risk communication and community engagement, routine surveillance, supply chain, vaccine delivery and planning	Gavi, Global Fund, Norad	HISP West Africa, MOH	Open source	National
Benin HMIS (DHIS2)	Benin's HMIS is a deployment of DHIS2. 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.	Coordination and operations, one Health	USAID	USAID Health Policy Plus, WAHIT, WAHO	Open source	National
Extract, Transform, Load (ETL) Application (DHIS2)	The ETL application automates the weekly import of integrated disease surveillance and response data from the Excel form used by countries into the WAHO regional DHIS2-based platform. Using the new process, country data managers are now able to easily feed information into the regional platform so that WAHO can continually monitor health events across the region.	Health facility and provider administration, vaccine delivery and planning	WAHO	MOH	Open source	National
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. For COVID-19 response, iHRIS can be adapted to manage and track health workers' vaccinations and to support workforce planning for COVID-19 hotspots.	Coordination and operations, supply chain		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
Logistics Data Visualization System (LDVS)	A web portal that the MOH uses to track inventories of commodities in the national health supply chain for 75 tracer medicines on a monthly basis. The Emergency Response Logistics Management System (ERLMS) is a new system integrated into the LDVS that will allow the MOH to easily create specific datasets (e.g., health facilities, medicines, medical supplies, PPE, equipment) to manage any type of public health emergency. The ERLMS is a dynamic system so that Benin can adapt the system to its changing needs.	Supply chain, vaccine delivery and planning		AMP, VillageReach	Open source	Subnational
Logivac+ (OpenLMIS)	Logivac+ is an informed push distribution system for immunization commodities. The ultimate goal of the Logivac+ is to increase the availability of high-quality vaccines at the last mile. Logivac+ can be adapted for COVID-19 supply chain management (e.g., COVID-19 vaccines, antiviral medicines, PPE).	Risk communication and community engagement		UNICEF	Open source	Subnational
U-Report	U-Report is a focused mHealth application, specifically providing real-time mobile counseling and conducting coordinated polls on HIV/AIDS among adolescents and young people. U-Report can be adapted to support COVID-19 response in Benin, as it has been done in several other African countries. For example, Mozambique deployed a U-Report information chatbot to support COVID-19 risk communication and community engagement.	Vaccine delivery and planning	Gates Foundation	eHealth Africa	Open source	Subnational
VaxTrac (CommCare)	VaxTrac is a clinic-based vaccination registry system that health workers can use in the field to enroll children and track their immunization records. VaxTrac actively manages the data and transactions from testing and vaccination events. The platform can be deployed as an end-to-end solution or in modules. It was designed to improve short- and long-term population health with simple overlays or changes to existing infrastructure and the implementation of a digital yellow card and secure fraud-proof health certificates. VaxTrac could be adopted for COVID-19 as an EIR for COVID-19 vaccinations.	Supply chain	WHO		Open source	Subnational
Zenysis	The Zenysis Analytics Platform is a commercial off-the-shelf data integration and advanced analytics platform used by national and state public health entities to enable data-driven emergency response activities, as well as routine program and resource management. Zenysis software can be used to integrate structured data from every available and relevant source, both within and beyond the health sector, into a single unified workspace for decision-makers. These workspaces, or "Virtual Control Rooms," can help significantly enhance situational awareness and disease surveillance and provide decisionmakers with analytics they need to coordinate containment efforts in a data-driven way. Using the Zenysis platform, emergency managers can view inventory levels and make quick decisions to move lifesaving health commodities and medical equipment from low-burden to high-burden facilities and geographies. To manage stockouts, alerts are created to flag when health facilities start reporting low stock. The Zenysis cohort tool enables public health professionals to conduct both cohort and cascade analyses on groups of patients by various dimensions over time. These types of analyses are key to understanding the key risk factors for transmission and the medical outcomes of subsets of the affected population. Geospatial tracking can be used to monitor outbreak hotspots, map gaps in availability of key services, and plan the location of new services. Zenysis is able to rapidly integrate and harmonize different versions of master facility registries to create a single source of truth for decision-makers. Using this data, Zenysis can calculate composite "COVID-19 readiness" scores that reflect the relative preparedness of a given facility and visualize these on private and/or public dashboards. The Zenysis platform can integrate patient-level testing data with immigration and customs data to identify contacts who traveled on planes or who transited through immigration arrival halls with people who have positive for COVID-19. It can also integrate patient-level testing data with ride-hailing app data to identify which drivers transported riders who tested positive for COVID-19. Zenysis can also integrate flight and ride-hailing app data into third-party contact tracing applications to avoid the need for slow, error prone and non-scalable data entry. For each patient or individual record, Zenysis platform users can visualize whom they were in contact with (derived from integrated sources), centralize information on each case (e.g., confirmed/suspected/exposed); and track each person's journey through diagnosis, isolation and/or care and treatment to monitor compliance and the need for follow-up.	Case management, contact tracing, coordination and operations, event-based surveillance, routine surveillance, supply chain, vaccine delivery and planning	Gates Foundation, Zenysis Technologies	Zenysis	Proprietary	National

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

At a glance

Figure 2 shows that Benin's digital health tools rely on different software licensing types with a mix of open source and proprietary tools. Figure 3 demonstrates that Benin has 16 digital health tools deployed on a national scale while 8 operate on a subnational scale. These figures are not specific to COVID-19 response, but they provide an overall picture of Benin's digital health infrastructure.

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

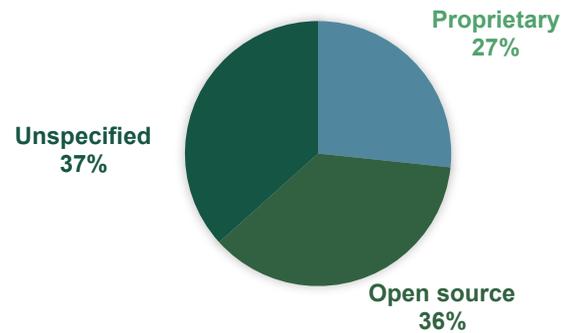
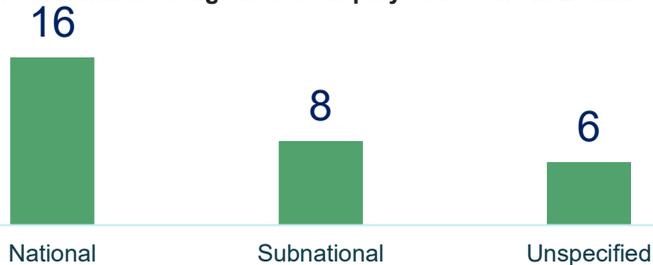


Figure 3. Number of digital tools deployed at scale in Benin.



Conclusion

Digital Square mapped 30 existing, adaptable digital health tools in Benin 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 Benin'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 Benin'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 Benin's digital health systems** and their role in the COVID-19 response by reviewing Benin'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.



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Annex 1. Abbreviations

Acronym	Definition
A/S D/S Orient's Fond	Aktieselskabet Dampskibsselskabet Orient's Fond
AMP	Agence de Médecine Préventive
ANCRE	Advancing Newborn, Child and Reproductive Health
CRS	Catholic Relief Services
DHIS2	District Health Information Software 2
EIR	electronic immunization registry
FDCO	UK Foreign Commonwealth & Development Office
GF	Global Fund
HISP	Health Information Systems Programme
HMIS	health management information system
iHRIS	integrated human resource information system
INMES	Institut national médico-social/National Medical and Social Institute
ITN	insecticide-treated net
LLINs	long-lasting insecticidal nets
LMIS	logistics management information system
MOH	Ministry of Health
MSH	Management Sciences for Health
Norad	Norwegian Agency for Development Cooperation
NTP	National Tuberculosis Program
PPE	personal protective equipment
SIIL	Système Informatisé d'Information Logistique
SMS	short message service
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WAHIT	West Africa Health Informatics Team
WAHO	West African Health Organization
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.