



Digital health systems to support pandemic response in Ghana

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

June 2021

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Introduction

Ghana's Ministry of Health (MOH) declares its vision statement in its 2010 *National E-health Strategy*: "E-health will enable the delivery of quality, affordable and up-to-date health services in an equitable and timely manner by enhancing communication and the use of information for planning, managing and delivering health services." The realization of this vision is paramount to effectively address the COVID-19 pandemic, which has put a strain on the health system. Leveraging digital health tools is a rapid, cost-effective strategy to accelerate Ghana's COVID-19 response while at the same time strengthening the health system at large.

Background

Digital Square conducted a landscape analysis of Ghana'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 Ghana, 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.

62
digital tools identified

25
tools scaled nationally

22
tools deployed for COVID-19

16
tools potentially adapted for COVID-19

Analysis overview

Map and Match's analysis found that Ghana's health system uses 62 digital health tools with at least 22 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 Ghana's digital health system's response to COVID-19. For example, infection and prevention control and points of entry have only one tool currently addressing these use cases. Laboratory systems and One Health currently do not have any tools fulfilling these use cases. 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 Ghana.



Figure 1 illustrates that many use cases are addressed using several tools in Ghana'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 Ghana'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 Ghana's COVID-19 response. Digital Square matched opportunities for tool adaptation across the pandemic use cases in **green** to reveal places where Ghana 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	Amplio Talking Book																
	Computer Aided Detection for COVID-19 (CAD4COVID)																
	CommCare																
	COVID-19 Triage Tool																
	COVID-CONNECT																
	DHIS2 (DHIS2 + Aggregate + Tracker)																
	e-learning modules on COVID-19																
	End-Use Verification (EUV) Activity surveys																
	GH COVID-19 Tracker App																
	iHRIS																
	mPedigree																
	MSME interactive voice response (IVR) survey tool (Viamo)																
	RapidPro																
	Real-time COVID-19 Tracker																
	RECOVR (ODK)																
	Redbird app																
	SafeCare/SafeCare4Covid																
	SORMAS (Surveillance Outbreak Response Management and Analysis System)																
	Vantage																

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

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

		PANDEMIC USE CASES															
		Case management	Contact tracing	Coordination and operations	Diagnostic tools	Event-based surveillance (including rapid response teams, case investigation)	Health facility and provider administration	Infection prevention and control	Laboratory systems	Learning and training	One Health	Points of entry	Risk communication and community engagement	Routine surveillance	Supply chain	Vaccine delivery and planning	
DIGITAL HEALTH TOOLS	Viamo 3-2-1 Service																
	World Continuing Education Alliance (WCEA)																
	Zipline																
	Ada Health App																
	AfriDoctor																
	Bahmni																
	Cadasta platform																
	Community Health Toolkit (CHT)																
	Early Warning System (CommCare)																
	Eneza Education																
	Fionet																
	Ghana Integrated Logistics Management Information System (GhiLMIS)																
	GxAlert																
	Integrated Disease Surveillance and Response (IDSR) (DHIS2)																
	Integrated Supportive Supervision (ISS) (ODK)																
	One Network/Resolve (OpenLMIS)																
	OpenMRS																
	Safe Delivery App (SDA)																
	U-Report (RapidPro)																

■ 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 the use case gaps below, which are infection prevention and control, laboratory systems, One Health, and points of entry. Use case gaps are defined as use cases that 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. 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.

Infection prevention and control

mPedigree	Cadasta platform
CommCare	

Laboratory systems

Bahmni	CommCare
DHIS2 (DHIS2 + Aggregate + Tracker)	GxAlert
SORMAS	

One Health

DHIS2 (DHIS2 + Aggregate + Tracker)	IDSR (DHIS2)
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Points of entry

SORMAS	CommCare
Community Health Toolkit	DHIS2 (DHIS2 + Aggregate + Tracker)
IDSR (DHIS2)	

Examples of global goods ready for adaptation for COVID-19 response in Ghana

Community Health Toolkit

Community Health Toolkit (CHT) is a collection of open source technologies and open access design, technical, and implementer resources and is a community of practice for digitally supported care delivery. It is designed to support community health systems and teams delivering care in the hardest-to-reach communities. Medic Mobile serves as the technical lead and initial steward—building and supporting the CHT as a global public good and facilitating contributions from others.

CHT-powered tools are supporting COVID-19 response efforts in the Democratic Republic of the Congo, Kenya, Malawi, Mali, Nepal, and Niger among others. CHT supports adaptations to primary care in response to COVID-19. CHT provides a remote training on COVID-19 for community health workers. CHT delivers routine health checks for community health workers, including mental health, well-being, and regarding adequate protective equipment.

10 PANDEMIC USE CASES	Case management
0 USE CASES UTILIZED	Coordination and operations
10 ADAPTATION OPPORTUNITIES IDENTIFIED	Contact tracing
	Event-based surveillance
	Health facility and provider administration
	Learning and training
	Points of entry
	Risk communication and community engagement
	Routine surveillance
	Vaccine delivery and planning

iHRIS

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

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

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

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

3 PANDEMIC USE CASES	Coordination and operations
2 USE CASES UTILIZED	Health facility and provider administration
1 ADAPTATION OPPORTUNITIES IDENTIFIED	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
Amplio Talking Book	The Amplio Talking Book is a rugged, battery-powered audio device for low-literate adults and youth that delivers local language messaging. Governments and development organizations use Talking Book to amplify their reach and share knowledge in rural remote communities. Talking Book overcomes barriers such as lack of infrastructure, illiteracy, and traditional gender norms and biases that often limit access to information. Talking Book has a cloud-based technology platform, an app to load new content and collect usage data and user feedback in the field, and a dashboard for monitoring and evaluating data for each community. Following the outbreak of COVID-19 in Ghana, GHS and Amplio Talking Book launched an awareness campaign to reduce the risk of contracting the disease in eight vulnerable districts in the Upper West Region. The eight districts included Jirapa, Nandom, Wa West, Nadowli, Lawra, Lambusie, Sissala West and Sisaala East. These districts were selected because they all share borders with Burkina Faso, which presents risk of cross-border spread. The campaign design considered a potential lockdown countrywide at the early stage of the pandemic and decided to leverage GHS local-level structures (e.g., CHPS facilities) and CHVs who could still operate during a lockdown situation as the campaign's frontline. Amplio and GHS jointly covered topics such as signs, symptoms, and causes of COVID-19, handwashing/sanitizing of hands, social distancing, correct mask usage, stigma, gender violence, and child abuse. From March to December 2020, 202 CHPS facilities implemented the campaign.	Learning and training, risk communication and community engagement	Amplio Network, Arm Ltd, UNICEF	Amplio, Amplio Ghana, GHS, MOH, UNICEF	Open source	Subnational
Computer Aided Detection for COVID-19 (CAD4COVID)	CAD4COVID is a free solution that uses AI on chest X-rays to triage suspected COVID-19 cases. CAD4COVID supports triaging in resource-constrained settings and high-prevalence areas. CAD4COVID has been added to the existing CAD4TB infrastructure in Ghana. CAD4COVID has been installed in 55 district hospitals across Ghana to analyze images of the lungs, and it detects COVID-19-related abnormalities.	Case management, diagnostic tools	RVO	Ghana Health Service, MOH	Freemium	National
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.	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		CRS	Open source	
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.	Diagnostic tools		Wellvis	Proprietary	
COVID-CONNECT	COVID-CONNECT is a pre-triage support application and patient flow management system that allows digital COVID-19 symptoms tracking at a distance. Users can track COVID-19 symptoms via a simple application downloadable via the App Store. A Care Coordination Center managed by medical professionals reaches out to patients who request a call back and/or who have potential COVID-19 symptoms to ensure they seek the right care at the right time. The system is pre-triage as it aims to relieve the health care system from being overrun by people and can monitor those with no/mild symptoms. COVID-CONNECT is currently available to all living in Greater Accra and will be soon available to anyone living in Ghana. This system supports the UGMC hospital to coordinate those in Greater Accra who have suspected COVID-19 symptoms.	Case management, diagnostic tools, event-based surveillance, routine surveillance	Achmea Foundation, FMO Development Bank	CarePay, Luscii, PharmAccess Foundation, UGMC	Proprietary	National
DHIS2 (DHIS2 + Aggregate + Tracker)	Ghana's District Health Information system on District Health Information Software 2 (DHIS2) is an open source, web-based platform, typically used as national health information systems for data management and analysis purposes, for health program monitoring and evaluation, as facility registries and service availability mapping, for logistics management, and for 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.	Case management, contact tracing, coordination and operations, diagnostic tools, event-based surveillance, health facility and provider administration, laboratory systems, learning and training, one health, points of entry, risk communication and community engagement, routine surveillance, supply chain, vaccine delivery and planning	CDC, DHIS2, Gates Foundation, Gavi, MOH, Norad, PEPFAR, The Global Fund, UNICEF, UNF, University of Oslo, WHO	DHIS2, HISP West Central Africa, 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
E-learning modules on COVID-19	This tool is a modular training on the triaging, diagnosing, and management of COVID-19 and infection prevention and control. The e-learning modules support the hospitals in Ghana and especially treatment centers on an easily accessible resource. They also support facilities to properly manage patients with COVID-19 while enhancing service continuity.	Learning and training	USAID	Jhpiego		National
End-Use Verification (EUV) Activity surveys	The EUV Activity is a quarterly survey that captures information about the malaria supply chain, diagnosis, and treatment at public health facilities in focus countries in sub-Saharan Africa. The EUV was strengthened as part of the GHSC-PSM project with expanded guidance on sampling, additional modules on reasons for stockouts and warehouse challenges, and most recently the addition of a module on the continuity of care in the context of COVID-19.	Health facility and provider administration, routine surveillance, supply chain	PMI, USAID	Centre for Health Information Management, JSI, National AIDS Control Program, National Tuberculosis Control Program, National Malaria Control Program, SSDM, USAID	Open source	National
GH COVID-19 Tracker App	The COVID-19 Tracker App is able to trace contacts of persons infected by the virus and show where they have been recently through various telephone-related data. It links people at risk to health professionals to recommend any necessary actions.	Contact tracing		GHS		National
iHRIS	iHRIS is a free and open source software solution that forms an integrated human resources information system, enabling countries to collect, maintain, and analyze health workforce data and manage health workforce re-sources at ministries of health, district health offices, and health care facilities more easily. iHRIS has been adapted in some countries to support COVID-19 response to manage and track health workers' vaccinations and to conduct workforce planning for COVID-19 hotspots and staffing needs (e.g., personal protective equipment).	Coordination and operations, health facility and provider administration, vaccine delivery and planning	USAID	MOH, WAHO	Open source	National
mPedigree	mPedigree is an innovative social enterprise anti-counterfeit ICT software application that enables the consumer to verify a medication's safety. mPedigree uses a simple sticker on the packaging, which, when scratched with a fingernail or coin, reveals a numeric code that can be verified by SMS, providing a direct confirmation of the drug's authenticity. mPedigree is a tool to secure the value chains of essential hygiene products (e.g., hand sanitizers, antiseptic, and soaps) to help citizens maintain good personal and home hygiene as a critical measure in the fight against COVID-19.	Infection prevention and control	Several Pharmaceutical Clients, US TSWG	Aliko Dangote Foundation, GBCHealth, Hewlett Packard, Orange Health, UNECA, West African Health Organization		National
MSME interactive voice response (IVR) survey tool (Viamo)	In Uganda, Ghana, Kenya, and Rwanda, Viamo has deployed longitudinal surveys to monitor the impact of pro-grams, COVID-19, and lockdowns on beneficiaries of Mastercard Foundation's grantees. These surveys use IVR technology, which allows anyone, regardless of literacy level, to access the information. In Ghana, the survey is targeted to participants of an MSME support program, including grants and loans. The surveys, offered in English and Twi, are designed to assess the impact of COVID-19 on Mastercard Foundation beneficiaries.	Contact tracing, learning and training, risk communication and community engagement, routine surveillance	Mastercard Foundation	Viamo	Proprietary	National
RapidPro	RapidPro is an open source platform that allows anyone to build interactive messaging systems using an easy visual interface. RapidPro works on basic feature phones and smartphones.	Risk communication and community engagement		Praekelt	Open source	National
Real-time COVID-19 Tracker	The Real-time COVID-19 Tracker provides policymakers and relevant parties with real-time information to track the spread of the virus and help them plan efficient interventions (e.g., drug and medical supply distribution, social distancing measures).	Coordination and operations				

 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
RECOVR (ODK)	Tracking how people's lives are affected by the COVID-19 pandemic can enable policymakers to better understand the situation in their countries and make data-driven policy decisions. To respond to this need, IPA has developed the RECOVR survey—a panel survey that facilitates comparisons, documents real-time trends of policy concern, and informs decision-makers about the communities that are hardest-hit by the economic toll of the pandemic.	Case management, event-based surveillance	Gates Foundation, Northwestern University's Global Poverty Research Lab, UBS Optimus Foundation	IPA, SurveyCTO	Open source	
Redbird app	The Redbird app is a telehealth diagnostic tool that manages COVID-19 reported symptoms, age, phone number, and birth year of users. Combined with GPS data, the app helps determine hardest hit areas and shares this information with health authorities and respondents.	Diagnostic tools	Founders Factory Africa, J&J Foundation, Newtown Partners			
SafeCare/SafeCare4Covid	SafeCare is a unique standards-based and International Society for Quality in Health Care–accredited incremental approach for measuring and improving the quality of health care services in low-resource settings. With the free, globally accessible SafeCare4Covid mobile app, facility staff can perform a self-assessment using their own mobile phones; report on the availability of equipment, staff, and supplies; and check on their own processes and knowledge to treat patients for COVID-19 while staying safe. Data derived from the SafeCare4Covid app can be used through dashboards by stakeholders for data-driven resource allocation and patient allocation.	Health facility and provider administration	GCC, PharmAccess Foundation	PharmAccess Foundation	Proprietary	Subnational
SORMAS (Surveillance Outbreak Response Management and Analysis System)	SORMAS is open source software that processes disease control and outbreak management procedures. SORMAS also provides real-time digital surveillance of peripheral health care facilities and laboratories, which facilitates early detection of outbreaks. GHS immediately activated a new COVID-19 module in more than 400 districts that were already using SORMAS.	Case management, contact tracing, coordination and operations, event-based surveillance, laboratory systems, points of entry, routine surveillance, vaccine delivery and planning	EU, GCNet, GHS, GIZ	Digital Square, GHS, SORMAS	Open source	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. In Ghana, Vantage has been used for contact tracing and monitoring program performance across 35 indicators.	Contact tracing, health facility and provider administration, learning and training, routine surveillance, supply chain, vaccine delivery and planning	CHAG	BroadReach	Proprietary	Subnational
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. The 3-2-1 Service delivers free, trusted, life-enhancing information by local, regional, and international subject matter experts to people on mobile devices. Such information can overcome barriers to early detection of life-threatening diseases; provide diagnostic advice, including self-diagnostic services; and provide treatment options through IVR. COVID-19 services via Viamo include national and regional awareness campaigns, mobile surveys, social media chat-bots, COVID-19 case reporting hotline, COVID-19 support call center, outbreak mapping and data visualizations, and remote training for health workers. In Ghana and the DRC, UNICEF creates messages on diagnosis and treatment of malaria, diarrhea, yellow fever, and other diseases with free and on-demand information.	Learning and training, risk communication and community engagement, routine surveillance		Viamo	Proprietary	
World Continuing Education Alliance (WCEA)	This learning management system is a multilingual eLearning and mHealth system that supports virtual and blended learning linked to certifications for professional development and lifelong learning. Examples of content include modules about nursing and midwifery and COVID-19 (both clinical and nonclinical). The platform generates reports on study habits and data of users (i.e., age, gender, location, qualification, role, employment status).	Learning and training		MOH, WCEA	Proprietary	National

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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
Zipline	Drones deliver medical supplies including vaccines, blood, and medicines to hard-to-reach areas of Ghana. For COVID-19, Zipline Drone Delivery has been used for delivery of medicines and other essential logistics. Zipline made its first COVID-19 test flight in April 2020 and has delivered samples collected from more than 1,000 health facilities in rural areas to laboratories in Accra and Kumasi.	Supply chain, vaccine delivery and planning	MOH	DHIS2	Public domain	Subnational
Ada Health App	The Ada Help App guides users to answer simple questions about their own or others' health and symptoms. Ada's AI assesses answers against its medical dictionary of thousands of disorders and conditions. Users receive a personalized assessment report that tells them what could be wrong and what to do next.	Diagnostic tools, risk communication and community engagement		Ada Health	Proprietary	
AfriDoctor	AfriDoctor is an online platform that digitizes patients' care paths and brings health providers closer to their patients. The platform allows patients to book online appointments with their providers and receive free SMS re-minders. The platform provides providers with a calendar management tool, invoicing and medical records management tool, and visibility/referencing of health structures.	Health facility and provider administration, learning and training, vaccine delivery and planning	Ecare Group, Investisseurs Privé	Aucun, Ecare Groupe	Proprietary	National
Bahmni	Bahmni is an open source EMR and hospital information system that is currently deployed in more than 50 countries. Bahmni is a distribution of the OpenMRS medical record platform that is designed to help health care providers to improve the efficiency and quality of patient care, reduce the margin of error in clinical diagnosis, and advocate for policies related to public health in rural areas. The system 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.	Case management, diagnostic tools, health facility and provider administration, laboratory systems, supply chain			Open source	
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 uses an Esri-based suite of best-in-class tools and technologies that takes the land-related data and migrates the data into government systems.	Infection prevention and control		Cadasta	Proprietary	
Community Health Toolkit (CHT)	CHT is a collection of open source technologies and open access design, technical, and implementer resources and is a community of practice for digitally supported care delivery. It is designed to support community health systems and teams delivering care in the hardest-to-reach communities. The CHT has been adapted in many countries for COVID-19 response to better facilitate investigation of COVID-19 alerts, as well as to effectively triage to ensure that those most at risk can access appropriate care in a timely manner.	Case management, coordination and operations, contact tracing, event-based surveillance, health facility and provider administration, learning and training, points of entry, risk communication and community engagement, routine surveillance, vaccine delivery and planning	Multiple	CRS, Medic Mobile, RHC Ghana	Open source	Subnational
Early Warning System (CommCare)	The Early Warning System provides real-time stock status information on reproductive health commodities to provide early warnings of a dip in supplies. Its automated, data-focused approach fosters effective supervision of ordering and delivery to ensure that essential health commodities are always available by facilitating consistent, planned orders and avoiding widespread emergency orders. The tool supports health workers and other mobile agents who manage commodities. The Early Warning System complements a functional LMIS with SMS and mobile technology to help address some of the health supply chain challenges, which include irregular and haphazard requisitions and late and incomplete reporting of stock status at the last mile that have resulted in occasional stockouts of essential health commodities at the service delivery point. The tool provides targeted, actionable information to supervisors and managers. It is a field-based, offline tool for recording drug transactions and integrating them with the inventory tracking system.	Event-based surveillance, supply chain	USAID	Dimagi, GHS, JSI, USAID	Open source	National
Eneza Education	Eneza Education is a subscription service for educational content designed for children in primary and secondary schools that is delivered via SMS or USSD. Users can sign up for a daily, weekly, or monthly subscription in Kenya, Ghana, and the Ivory Coast.	Learning and training, risk communication and community engagement			Don't know	

 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
Fionet	The Fionet platform combines point-of-care, handheld devices connected to online, AI-powered data services. The technology enables off-site health supervisors to see and adjust frontline health care activity and needs.	Case management, event-based surveillance	Fio Corporation, Fio Health Ghana Ltd., GHS	Fio Corporation, Fio Health Ghana Ltd., GHS	Proprietary	Subnational
Ghana Integrated Logistics Management Information System (GhiL-MIS)	GhiLMIS is an eLMIS that will integrate stock information across all program areas. GhiLMIS facilitates the integration of the supply chain processes with other business functions. GhiLMIS enables the delivery of the highest quality products and services at a reduced cost as well as increased responsiveness to customer needs. GhiLMIS provides quick data access, optimizes business processes (aligns logistics business processes to other information systems), and ensures that patients get their medications on time.	Supply chain		GHS, MOH	Open source	Subnational
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 managers and M&E systems. GxAlert can also send targeted SMS alerts to facility managers, health officers, and suppliers. The tool collects and transmits electronic diagnostic and operational data directly from diagnostic instruments.	Diagnostic tools, event-based surveillance, laboratory systems	TB REACH	SystemOne	Proprietary	National
Integrated Disease Surveillance and Response (IDSR) (DHIS2)	The IDSR is Ghana's disease surveillance system. IDSR data has been reported through the DHIS2 network since 2012 in Ghana.	Event-based surveillance, one health, points of entry		GHS	Open source	
Integrated Supportive Supervision (ISS) (ODK)	ISS is an electronic checklist used for supervision during active case search and routine immunization.	Case management, vaccine delivery and planning	WHO		Open source	National
One Network/Resolve (OpenLMIS)	Vitaliance's eLMIS is deployed at scale in Ghana. It provides real-time inventory data, contraceptive order visibility, and processing and warehouse management. eLMIS provides data on pharmaceuticals and other medical commodities in the supply chain and tracks their flow from distribution centers dotted around the country to hospitals, clinics, and ultimately the patients. The system also tracks expiration dates, so that older medicines can be prioritized and consumed so there is less waste. Vitaliance LMIS is available as a cloud-based SaaS, and it supports multiuser interfaces for web browsers, smartphones, and tablets.	Supply chain		Vitaliance Corp	Open source	Subnational
OpenMRS	OpenMRS is a software platform and a reference application that enables design of a customized medical records system. OpenMRS has adapted its software to make it easier for 5,500 existing implementations to screen, test, and manage patients and to report data out efficiently to DHIS2 for public health surveillance.	Case management, contact tracing, event-based surveillance, health facility and provider administration, routine surveillance, vaccine delivery and planning		Millennium Villages Project, Novartis Foundation	Open source	Subnational
Safe Delivery App (SDA)	SDA supports skilled birth attendants to quickly diagnose issues in pregnancy and with newborns, offering step-by-step guidelines to perform treatments. 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. SDA formally launched in Ghana in 2017 and has been integrated into trainings carried out by UNFPA, GHS, CHAG, and NORSAAC and virtual trainings by the MOH. SDA includes the adaptation of a COVID-19 content module that provides skilled birth attendants (e.g., midwives) with key information, animated video instructions, and check-lists 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	Gates Foundation, Merck for Mothers	Aarhus University, CHAG, GHS, NORSAAC, UNFPA	Open source	National
U-Report (RapidPro)	U-Report is a social messaging tool and data collection system to improve citizen engagement, inform leaders, and foster positive change. The program sends SMS polls and alerts to its participants, collecting real-time re-sponses, and subsequently publishes gathered data.	Risk communication and community engagement	UNICEF	UNICEF	Open source	National

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

At a glance

Figure 2 shows that Ghana's digital health tools rely on different software licensing types for sustainability with open source and proprietary being the most common. Figure 3 demonstrates that Ghana has 25 digital health tools deployed on a national scale while 18 operate on a subnational scale. A limitation of the Map and Match analysis was the inability to find complete information about licensing type and scale of some of these tools in Ghana. These figures are not specific to COVID-19 response, but they provide an overall picture of Ghana's digital health infrastructure.

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

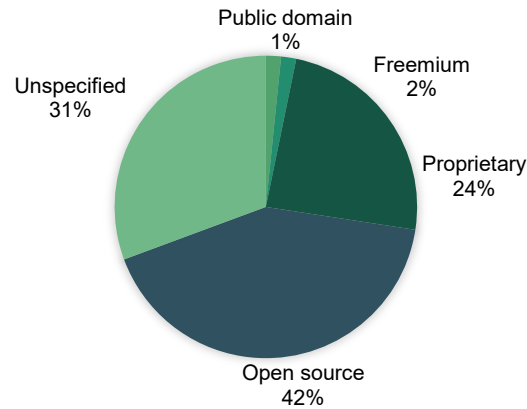






Figure 3. Number of digital tools deployed at scale in Ghana.



Conclusion

Digital Square mapped 62 existing, adaptable digital health tools in Ghana 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 Ghana'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 Ghana'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 Ghana's digital health systems and their role in the COVID-19 response by reviewing Ghana'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
AI	artificial intelligence
CDC	Centers for Disease Control and Prevention
CHAG	Christian Health Association of Ghana
CHPS	Certified in Healthcare Privacy and Security
CHVs	community health volunteers
CRS	Catholic Relief Services
DHIS2	District Health Information Software 2
DRC	Democratic Republic of the Congo
EMR	electronic medical records
EU	European Union
FMO Development Bank N.V.	Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden N.V.
Gavi	Gavi, the Vaccine Alliance
GCC	Grand Challenges Canada
GCNet	Ghana Community Network
GHS	Ghana Health Services
GHSC-PSM	USAID Global Health Supply Chain Program–Procurement Supply Management
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	global positioning system
HISP	Health Information Systems Programme
ICT	information and communications technology
IDSR	Integrated Disease Surveillance and Response
IPA	Innovations for Poverty Action
IVR	interactive voice response
J&J	Johnson & Johnson
JSI	John Snow International
LMIS	logistics management information system

Acronym	Definition
M&E	monitoring and evaluation
MOH	Ministry of Health
MSME	small and medium enterprises
Norad	Norwegian Agency for Development Cooperation
NORSAAC	Northern Sector Action on Awareness Center
ODK	Open Data Kit
PEPFAR	President’s Emergency Plan for AIDS Relief
PMI	President’s Malaria Initiative
RHC	Rural Health Collaborative
RVO	Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland)
SaaS	software as a service
SMS	short message service
SORMAS	Surveillance Outbreak Response Management and Analysis System
SSDM	Stores, Supplies and Drugs Management
TB	tuberculosis
UGMC	University of Ghana Medical Centre
UNECA	United Nations Economic Commission for Africa
UNF	United Nations Foundation
UNFPA	United Nations Population Fund
UNICEF	United Nations Children’s Fund
US TSWG	U.S. Technical Support Working Group
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data
WAHO	West African Health Organization
WCEA	World Continuing Education Alliance
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.