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

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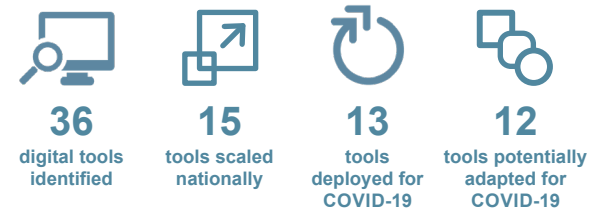
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Introduction

Cameroon's Ministry of Public Health (MOH) outlines its vision in The 2020–2024 National Digital Health Strategic Plan stating that, "By 2024, digital health will effectively contribute to universal health coverage through informed decision-making at all levels of the health pyramid, and through reliable, robust, secure, and interoperable systems." The MOH shared that COVID-19 has not changed the vision of the digital health strategy, but it has slowed down implementation of the plan at a critical time. Leveraging digital health tools is a rapid, cost-effective strategy to accelerate Cameroon's COVID-19 response while at the same time reinforcing the MOH's vision.

Background

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

36 digital tools identified

15 tools scaled nationally

13 tools deployed for COVID-19

12 tools potentially adapted for COVID-19

Analysis overview

Map and Match's analysis found that Cameroon's health system uses 36 digital health tools with at least 13 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 Cameroon's digital health systems' response to COVID-19. For example, the analysis identified only one tool that currently supports points of entry, with additional tools ready for adaptation to further address this use case.

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

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

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

Key definitions

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

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

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

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

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

Tool	Case management	Contact tracing	Coordination and operations	Diagnostic tools	Event-based surveillance (including rapid response teams, case investigation)	Health facility and provider administration	Infection prevention and control	Laboratory systems	Learning and training	One Health	Points of entry	Risk communication and community engagement	Routine surveillance	Supply chain	Vaccine delivery and planning
#FollowTheMoney												B			
CAD4COVID	B			B	B		B								
COVID-19 risk monitoring and forecasting model					B	B			B			B			
DataToCare	B		B		B			B						B	
DHIS2 (DHIS2+ COVID-19 Surveillance + Tracker)	B	B	G	G	B	G		G				G			G
KoBoCollect (ODK)	G	B			G						B				
LoMIS Suite														B	B
openIMIS															B
OpenLMIS COVID-19 Edition														B	B
Safe Delivery App									B						
Teachme Covid												B			
WeCareUp COVID-19: Universal Platform	B														
Wellvis COVID-19 Triage Tool	B						B					B			
Amplio Talking Book									G			G			
AVADAR (Auto-Visual AFP Detection and Reporting) (ODK)		G			G										
Bahmni	G			G	G	G					G				
BornFyne	G				G								G		
CommCare	G	G			G	G	G	G				G	G	G	

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

Table 1. Mapping and matching digital health tools to strengthen Cameroon'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
eHA Data Portal			██		██										
GNU Health	██					██									
Hesabu						██									
PlanFeld (ODK)															██
Tiko Explore												██			
U-Report												██			
VigiFlow								██							

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

"COVID-19 was new for all countries, so we had to review all the tools used in surveillance, case notification, alerts, contact tracing, screening, WASH, infection prevention and control, burial/decontamination procedures, and clinical/psychological management. Many of these use cases were not included in the routine tools. We tried Go.Data, KoBoCollect, and other various novel tools for COVID-19 response that were not initially present in a defined core information system. Real-time data collection is the most important, and this was difficult at the community level."
(page 3)

—From key informant interviews with country-level stakeholders, Cameroon

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 five use case gaps. 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.

Coordination and operations

DataToCare	DHIS2 + Tracker
eHA Data Portal	

Diagnostic tools

CAD4COVID	Bahmni
DHIS2 + Tracker	

Health facility and provider administration

COVID-19 risk monitoring and forecasting model	Bahmni
CommCare	DHIS2 + Tracker
GNU Health	Hesabu

Laboratory systems

DataToCare	CommCare
DHIS2 + Tracker	VigiFlow

Points of entry

KoBoCollect (ODK)	Bahmni
CommCare	

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

Bahmni (OpenMRS)

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

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

5 PANDEMIC USE CASES

0 USE CASES UTILIZED

5 ADAPTATION OPPORTUNITIES IDENTIFIED

- Case management
- Diagnostic tools
- Health facility and provider adminstration
- Laboratory systems
- Supply chain

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.

Dimagi worked to rapidly design and deploy a set of free, templatized CommCare applications and reporting options using mobile, web, and short message service (SMS). These applications have been applied to a wide variety of COVID-19 use cases, including community preparedness, contact tracing, facility readiness assessment, point-of-entry screening, and health worker education. More than 25,000 users from more than 70 organizations and governments have used CommCare for a variety of use cases in more than 30 countries.

9 PANDEMIC USE CASES

0 USE CASES UTILIZED

9 ADAPTATION OPPORTUNITIES IDENTIFIED

- Case management
- Contact tracing
- Event-based surveillance
- Health facility and provider administration
- Infection prevention and control
- Laboratory systems
- Learning and training
- Points of entry
- Risk communication and community engagement

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
#FollowTheMoney	A social accountability platform that is a tool to mobilize, advocate, visualize, and track government and international aid spending in rural grassroots communities. For COVID-19, #FollowTheMoney is tracking international and national aid invested in the fight to stop COVID-19.	Risk communication and community engagement	Budgit	Actions for Development and Empowerment	Public domain	National
CAD4COVID	CAD4COVID is a free solution that uses artificial intelligence on chest X-rays to triage suspected COVID-19 cases. CAD4COVID supports triaging in resource-constrained settings and high-prevalence areas.	Case management, diagnostic tools, event-based surveillance, infection prevention and control		Delft Imaging	Freemium	National
COVID-19 risk monitoring and forecasting model	This tool monitors and projects the risks associated with COVID-19. Cameroon adapted this tool as part of a research activity to respond to COVID-19. An article in Science journal titled "Policy interface for responding to COVID-19 in Cameroon: from global outlook to local action" will be published with more details on this COVID-19 risk monitoring and forecasting model.	Event-based surveillance, health facility and provider administration, learning and training, risk communication and community engagement	Financement personnel	Université de Dschang, Personnel	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 across Cameroon in laboratories to collect and transfer diagnostic data and send via internet or SMS to the central server. The DataToCare server computes diagnostic or epidemiological data from points of care and remote laboratories. Data on the central server are used to create a dashboard that provides national/regional/provincial overviews of the data in real time. DataToCare also allows notification of the test results to clients via SMS as soon as the test results are available and validated by the operator.	Case management, coordination and operations, event-based surveillance, laboratory systems, routine surveillance	WHO	Savics, WHO	Proprietary	National
DHIS2 (DHIS2 + COVID-19 Surveillance + Tracker)	DHIS2 is an open source, web-based HMIS platform. 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. The DHIS2 COVID-19 digital data package has been adapted in Cameroon to accelerate case detection, enable situation reporting, and conduct active surveillance. The COVID-19 digital data package includes standard metadata aligned with the WHO's technical guidance on COVID-19 surveillance and has been adapted to local country context and language in this implementation. DHIS2 Tracker allows users to define a particular kind of thing (person, commodity, lab sample, catchment area, etc.) that they want to follow over time (a tracked entity), define the data that they want to collect about this entity (data elements), place the data elements in a specific order and with any accompanying conditions or logic (program, program rules), and determine the analytics that should be produced (program indicators, event reports, data visualizations, etc.).	Case management, contact tracing, coordination and operations, diagnostic tools, event-based surveillance, health facility and provider administration, laboratory systems, points of entry, risk communication and community engagement, supply chain, routine surveillance	DHIS2, Gavi, MOH, Norad, The Global Fund	DHIS2, HISP West Central Africa, MOH	Open source	National
KoBoCollect (ODK)	KoBoCollect is based on the open source Collect app by getODK and is used for primary data collection in humanitarian emergencies and other challenging field environments. This app allows online or offline data entry (e.g., from interviews). There are no limits on the number of forms, questions, or submissions (including photos and other media) that can be saved on a device. This app is not used on a regular basis in Cameroon, but it is used when there is a gap in indicators to fill in missing data. Cameroon uses KoBoCollect for COVID-19 surveillance and psychological care.	Case management, contact tracing, event-based surveillance, points of entry			Open source	

🟦 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
LoMIS Suite	LoMIS Stock and LoMIS Deliver are a suite of mobile and web applications to address supply chain challenges. LoMIS Stock enables health workers to bypass traditional (slow) paper-based reporting systems and submit reports instantly using an app on their mobile device. LoMIS Stock enables supervisors to receive near real-time visibility of stock level at health facilities for planning and decision-making. The data from LoMIS Stock is used to plan and schedule product deliveries to restock health facilities. Built specially to aid drivers during delivery to health facilities, LoMIS Deliver automates the process of the paper-based ledger entry to capture stock quantity delivered and on-hand quantity at health facilities. For COVID-19 response, Cameroon adapted LoMIS Stock to serve as an electronic inventory and health commodities management system. This system supports NCDC to track and monitor stock inventory and utilization of COVID-19 commodities in states, treatment centers, isolation centers, and laboratories.	**Supply chain, vaccine delivery and planning**	eHealth Africa, NCDC	eHealth Africa	Open source	
openIMIS	This tool offers an intuitive, user-friendly interface to manage the complex processes used in health protection schemes. These include client management, health services' claims generation, transmission, and review. By applying industry standards, openIMIS provides a seamless exchange of client, health service provider, and scheme operator data.	**Vaccine delivery and planning**	MISEREOR	BEPHA, SwissTPH	Open source	Subnational
OpenLMIS COVID-19 Edition	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.	**Supply chain, vaccine delivery and planning**	Gates Foundation	CHAI, MOH	Open source	Subnational
Safe Delivery App	The Safe Delivery App supports skilled birth attendants to quickly diagnose issues in pregnancy and with newborns, offering step-by-step guidelines to perform a treatment. It is free to download and can be preinstalled so that providers can watch the animated instruction videos and read the action cards and drug lists whether or not they have Wi-Fi. The Safe Delivery App includes the adaptation of a COVID-19 content module that provides skilled birth attendants (e.g., midwives) with key information, animated video instructions, and checklists to support them to limit the spread of COVID-19 in the health facilities, including information on infection prevention, breastfeeding, and vertical transmission.	**Learning and training**	Gates Foundation, Maternity Foundation, Merck for Mothers, UNFPA	Denmark's Maternity Foundation, Merck for Mothers	Open source	National
Teachme Covid	A website in local languages that provides COVID-19 prevention information. The tool also provides information through phone messages.	**Risk communication and community engagement**		Teachmepad, UNDP	Public domain	National
WeCareUp COVID-19: Universal Platform	WeCareUp enables hospitals to organize mass COVID-19 screenings in their communities to quickly manage infected patients and rapidly implement appropriate care interventions. WeCareUp diagnoses other diseases and makes it possible to refer patients in real time to the appropriate hospitals based on their medical histories, the seriousness of their cases, and the availability of beds and doctors' skills.	**Case management**				Subnational
Wellvis COVID-19 Triage Tool	The 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, infection prevention and control, risk communication and community engagement**	Africa CDC, CcHUB, GIZ	Wellvis	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
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. Program managers create content, which is organized into playlists and uploaded to the Talking Book via a USB connection (either to a computer, tablet, or smartphone). A series of voice prompts, also customizable in local language, allows users to move through curated playlists. Users can record comments or ask questions. Listening can occur in individual/household rotations, group listening sessions, or by placing the device at health centers or community gathering places. 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.	**Learning and training, risk communication and community engagement**	Universite Numerique Francophone Mondiale	Universite Numerique Francophone Mondiale	Open source	Subnational
AVADAR (Auto-Visual AFP Detection and Reporting) (ODK)	AVADAR is an SMS-based mobile technology innovation to improve completeness, timeliness, and availability of acute flaccid paralysis (AFP) reporting data. AVADAR widens the net of disease reporters, making data available in near real time, sending automatic case alerts to disease surveillance officers, and automatically aggregating and visualizing case alerts and investigations on a dashboard.	**Contact tracing, event-based surveillance**	Gates Foundation	CDC, eHealth Africa, Nafundi, Novel-T, WHO	Open source	Subnational
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. In Cameroon, Bahmni is being piloted for HIV patient tracking.	**Case management, diagnostic tools, event-based surveillance, health facility and provider administration, points of entry**	CDC, PEPFAR	Jembi	Open source	
BornFyne	BornFyne is a mobile phone application that acts as a prenatal management system. BornFyne is accessible to non-literate groups by using pictographs. The app communicates emergencies to health workers using GIS in Cameroon. The app is designed as a tool to address maternal mortality and reproductive health among rural poor women in Cameroon by increasing access to maternal and reproductive health services, as well as providing e-vouchers for transportation.	**Case management, event-based surveillance, routine surveillance**	Grand Challenges Canada	SEPH, University of Ottawa		Subnational
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. In Cameroon, CommCare is not a platform managed at the national level, but instead it is used for surveillance micro-projects in border areas.	**Case management, contact tracing, event-based surveillance, health facility and provider administration, infection prevention control, laboratory systems, learning and training, point of entry, risk communication and community engagement, supply chain**	PEPFAR	CBC, Peace Corps Cameroon	Open source	Subnational
eHA Data Portal	eHA Data Portal is a web application that makes robust catalogued geospatial data readily available to the public for global good use (e.g., public health planning and humanitarian activities).	**Coordination and operations, event-based surveillance**	CDC, eHealth Africa, Gates Foundation	eHealth Africa, WHO	Open source	National
GNU Health	GNU Health HMIS is standards-based system that manages the internal processes of a health institution, such as financial management, billing, stock management, pharmacies, and/or labs (LIMS). GNU Health HMIS provides more than 40 modules (e.g., primary care, obstetrics and gynecology, pediatrics, surgery, genetics, diagnostic imaging, reporting) for health institutions.	**Case management, health facility and provider administration**	WHO, Recover Foundation	Blue Rose Projects, GNU Solidario	Open source	Subnational

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

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

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
Hesabu	Hesabu is a data system that manage PBF, including offline mobile data collection of quality of care and client satisfaction, the computation of program indicators, the calculation of incentive bonuses, the management of the PBF primary and subcontractor relationships, and distribution of incentives. Hesabu displays data publicly through open data dashboards.	**Health facility and provider administration**	World Bank	Bluesquare	Open source	Subnational
PlanFeld (ODK)	PlanFeld is a web-based application used to plan field logistics for public health interventions. PlanFeld enables large-scale data collection exercises and supports health service delivery. PlanFeld is a highly intuitive tool making it easy for users to use advanced analytics and geospatial data to generate robust plans, monitor field interventions, and make improved decisions in near real time.	**Vaccine delivery and planning**	CDC, Gates Foundation	CDC, eHealth Africa, UNICEF, WHO	Open source	Subnational
Tiko Explore	Tiko Explore delivers information on demand. It uses reminders, discounts, and reward points to encourage users to access and use healthy products and services related to MNCH, reproductive, and sexual health (including HIV). Tiko Explore targets young women. Tiko Explore is available via the web or by using an application delivered on mobile devices (i.e., feature phones, smartphones, tablets).	**Risk communication and community engagement**	CIFF, Cordaid, KFW, Ministry of Foreign Affairs Netherlands, Rutgers	Triggerise	Open source	Subnational
U-Report	U-Report is a mHealth application that provides real time mobile counseling and conducts coordinated polls on HIV/AIDS among adolescents and young people.	**Risk communication and community engagement**	UNICEF	UNICEF	Open source	National
VigiFlow	VigiFlow is a management system for recording, processing, and sharing reports of adverse effects for medical products. VigiFlow enables maximum local control and provides an effective means for management review and analysis of national data.	**Laboratory systems**	WHO		Open source	Subnational

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"The real challenge is reaching interoperability across all these systems. Even in DHIS2 and other platforms, we struggle to make all these systems communicate to have complete enough data. Data are fragmented. The digital health strategic plan should contribute to solving these issues, but it remains poorly funded."

—From key informant interviews with country-level stakeholders, Cameroon

At a glance

Figures 2 shows that Cameroon's digital health tools rely on different software licensing types for sustainability with open source being the most common. Figure 3 demonstrates that Cameroon has 15 digital health tools deployed on a national scale while 14 operate on a subnational scale. These figures are not specific to COVID-19 response, but they provide an overall picture of Cameroon's digital health infrastructure.

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

- Freemium 3%
- Public domain 7%
- Unspecified 6%
- Proprietary 16%
- Open source 68%
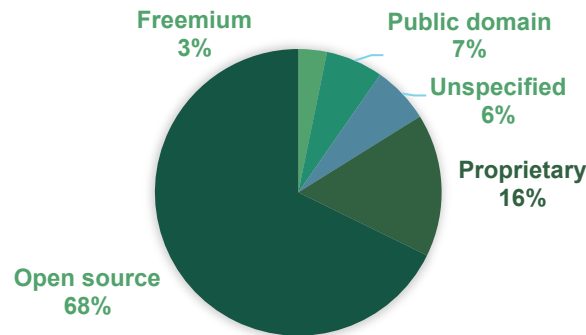
Figure 3. Number of digital tools deployed at scale in Cameroon.

National	Subnational	Unspecified
15	14	7
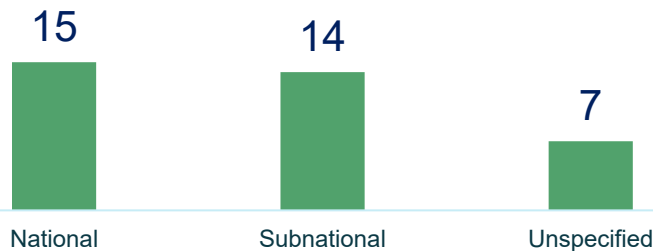
Conclusion

Digital Square mapped 36 existing, adaptable digital health tools in Cameroon 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 Cameroon'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 Cameroon'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 Cameroon's digital health systems** and their role in the COVID-19 response by reviewing Cameroon's full Map and Match dataset.

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

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

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

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

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

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

Annex 1. Abbreviations

Acronym	Definition
BEPHA	Bamenda Ecclesiastical Province Health Assistance
CBC	Cameroon Baptist Convention
CcHUB	Co-Creation Hub
CDC	US Centers for Disease Control and Prevention
CHAI	Clinton Health Access Initiative
CIFF	Children Investment Fund Foundation
DHIS2	District Health Information Software
EMR	electronic medical record
GIS	geographic information system
HISP	Health Information Systems Programme
HMIS	health management information system
KfW	German KfW Development Bank
LIMS	laboratory information management system
LMIS	logistics management information system
MISEREOR	German Catholic Bishops' Organisation for Development Cooperation
MNCH	maternal, newborn and child health
MOH	Ministry of Public Health
NCDC	Nigeria Centre for Disease Control
Norad	Norwegian Agency for Development Cooperation
ODK	Open Data Kit
PBF	performance-based financing
PEPFAR	US President's Emergency Plan for AIDS Relief
SEPH	Faculty of Medicine's School of Epidemiology and Public Health
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

Acronym	Definition
WASH	water, sanitation, and hygiene
WHO	World Health Organization

Annex 2. Use case definitions

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

Annex 3. Digital tools supporting vaccine deployment

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

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

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

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

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

Digital Square approved global goods use cases

Electronic immunization registries
DHIS2 Tracker, OpenSRP, OpenMRS, Tamanu

Messaging
CommCare, Community Health Toolkit, mHero, OpenSRP

Microplanning
Healthsites, OpenSRP, Reveal

Patient monitoring
CommCare, DHIS2 Tracker, OpenSRP, SORMAS

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

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

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

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

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

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

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

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

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

Areas the COVID-19 DICE covers include:

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