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

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

June 2021

IN THIS TECHNICAL BRIEF

Introduction

The Ministry of Health and Family Welfare (MOHFW) supported by the World Health Organization (WHO) Bangladesh is currently developing a national digital health strategy, and the COVID-19 pandemic underscores the need for this guiding road map. Dr. Bhupinder Aulakh, WHO Deputy Country Representative to Bangladesh, explains: "The need for digital health has never been more visible and acute than since the start of the COVID-19 pandemic when disrupted access to health service has forced health care providers and patients to employ alternative means to access and deliver health services."[1] Leveraging digital health tools is a rapid, cost-effective strategy to accelerate Bangladesh's COVID-19 response while at the same time reinforcing the health system at large.

Background

Digital Square conducted a landscape analysis of Bangladesh'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 Bangladesh, map the tools already deployed for COVID-19 response to relevant use cases, and highlight opportunities where existing tools can quickly be adapted and deployed to support COVID-19 response.

51 digital tools identified

18 tools scaled nationally

18 tools deployed for COVID-19

12 tools potentially adapted for COVID-19

Analysis overview

Map and Match's analysis found that Bangladesh's health system uses 51 digital health tools, with at least 18 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 Bangladesh's digital health systems' response to COVID-19. For example, the analysis did not identify tools that currently support pandemic response contact tracing, infection prevention and control, One Health, or points of entry. 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 Bangladesh.
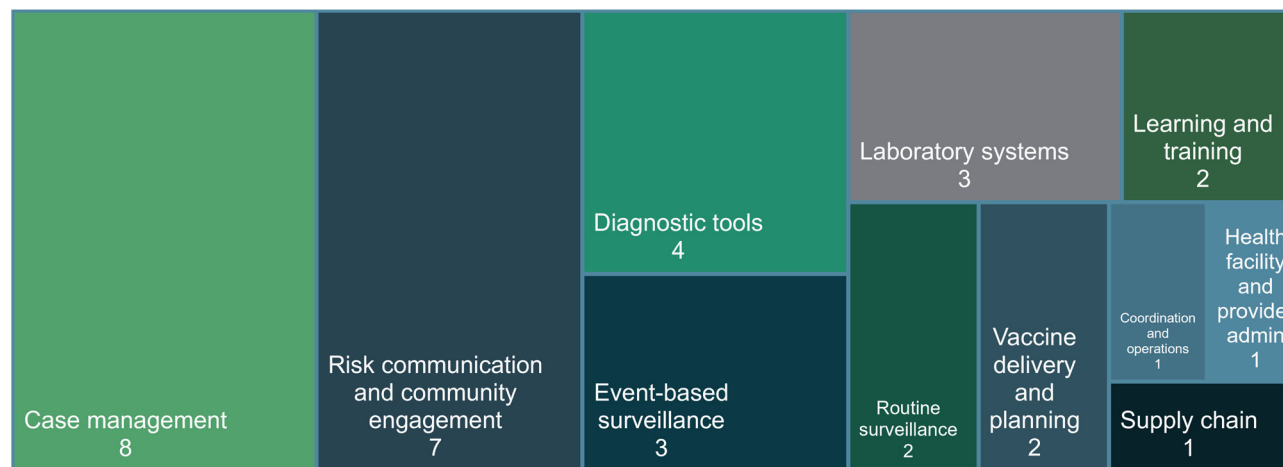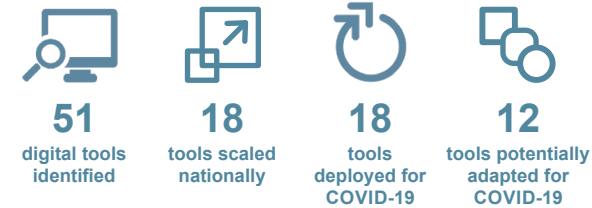

Figure 1 illustrates that many use cases are addressed using several tools in Bangladesh's COVID-19 response while other use cases are filled by a sole tool.

1. Advancing digital health strategy in Bangladesh [news release]. Dhaka: WHO; January 3, 2021. https://www.who.int/bangladesh/news/detail/03-01-2021-advancing-digital-health-strategy-in-bangladesh.

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.

Digital Square and USAID attempted outreach efforts to the MOHFW 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 Bangladesh'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 Bangladesh's COVID-19 response. Digital Square matched opportunities for tool adaptation across the pandemic use cases in **green** to reveal places where Bangladesh can reuse parts of its existing digital health systems to strengthen its COVID-19 response.

PANDEMIC USE CASES

DIGITAL HEALTH TOOLS	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
Bangladesh HMIS (DHIS2 + Aggregate + Tracker)	green	green	blue	green	blue			blue		green	green	blue		green	blue
CMED Health				blue											
CommCare	blue	green			green	green	green	green	green		green	green			
Computer Aided Detection for COVID-19 (CAD4COVID)				blue											
Coronavirus (COVID-19) Situation in Bangladesh 2020												blue			
Esri Bangladesh: COVID 19 Situation Response												blue			
Everwell Hub	blue			blue	blue			blue							
Health Call Center 16263												blue			
HealthAlert												blue			
Maya	blue														
MonerDaktar	blue														
Open Data Kit (ODK)	blue														
OpenCRVS	blue														
OpenMRS+ (Bahmni)	blue			blue	blue	blue		blue						blue	
RapidPro												blue	blue		
Safe Delivery App									blue						
Surakṣā												blue			blue
World Continuing Education Alliance									blue						

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

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Amplio Talking Book									■			■			
CAD4TB				■											
Cadasta platform														■	
ColdTrace														■	■
GxAlert			■					■							
KoBoToolbox					■										
MEDSINC Clinical Decision Support Tool	■			■	■										
Open Smart Register Platform (OpenSRP)	■	■		■	■	■	■	■	■			■	■	■	■
OpenMRS	■				■										■
Simprints	■														■
True Cover: Localized, Accurate Immunization Coverage															■
VigiFlow								■							

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

"DHIS2 has been serving Bangladesh for a very long time and has become a national tool for the whole health sector. The DHIS2 Tracker deployment in Bangladesh is one of the largest in the world."

—Hannan Khan, HiSP Bangladesh

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

Map and Match's analysis identified existing digital tools that can be adapted to support COVID-19 response for all use case gaps below, including contact tracing, coordination and operations, health facility and provider administration, infection prevention and control, One Health, points of entry, and supply chain. Use case gaps are defined as use cases that have fewer than two tools addressing them.

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

Contact tracing

Bangladesh HMIS (DHIS2 + Aggregate + Tracker)	CommCare
ODK	OpenSRP

Coordination and operations

Bangladesh HMIS (DHIS2 + Aggregate + Tracker)	GxAlert

Health facility and provider administration

OpenMRS+ (Bahmni)	CommCare
OpenSRP	

Infection prevention and control

CommCare	OpenSRP

One Health

Bangladesh HMIS (DHIS2 + Aggregate + Tracker)

Points of entry

Bangladesh HMIS (DHIS2 + Aggregate + Tracker)	CommCare

Supply chain

OpenMRS+ (Bahmni)	Bangladesh HMIS (DHIS2 + Aggregate + Tracker)
ColdTrace	OpenSRP

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

Bangladesh HMIS (DHIS2 with Tracker)

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

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

Open Smart Register Platform (OpenSRP)

OpenSRP is an offline-capable open source mobile health platform built to enable data-driven decision-making at all levels of the health system. OpenSRP supports the health worker to prioritize point-of-care tasks, track service delivery, and simplify reporting. OpenSRP has been used to build localized applications for reproductive, maternal, newborn, child, and adolescent health; immunization; early childhood development; malaria rapid diagnosis and management; and tuberculosis treatment management.

OpenSRP is currently supporting COVID-19 response in other countries. For example, OpenSRP is working with the Indonesia and Malawi governments to support the COVID-19 response through the adaptation of the COVID Testing and Screening App. OpenSRP works with other digital tools like Reveal to facilitate contact tracing and with Akuko, a data storytelling platform, to provide a data visualization platform for information sharing.

12 PANDEMIC USE CASES
6 USE CASES UTILIZED
6 ADAPTATION OPPORTUNITIES IDENTIFIED

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

11 PANDEMIC USE CASES
0 USE CASES UTILIZED
11 ADAPTATION OPPORTUNITIES IDENTIFIED

- Case management
- Contact tracing
- Diagnostic tools
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- Health facility and provider administration
- Infection prevention and control
- Laboratory systems
- Learning and training
- Routine surveillance
- Supply chain
- Vaccine delivery and planning

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

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
Bangladesh HMIS (DHIS2 + Aggregate + Tracker)	DHIS2 is an open source, web-based HMIS platform used by more than 100 countries. 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. Bangladesh's MOHFW has been using DHIS2 for data collection, analysis, and dashboard development for decision-making. Bangladesh's customized DHIS2 includes the following functionality: COVID-19 surveillance system, medical cause of death registration, maternal tracking, under-5 child tracking, and cervical and breast cancer patient tracking. Bangladesh customized the existing COVID-19 system (DHIS2) package as per its needs and implemented a case-based tracking system (DHIS2) throughout the whole country. The MOHFW Department of Global Health Security team staff uses this software at all COVID-19 test laboratories and sample collection centers (both government and nongovernment facilities). The system collects individual patient data. The country dashboard and WHO receive data through the DHIS2 COVID-19 surveillance system. The public can print their own COVID-19 test certificate through OTP, and COVID-19 test results are sent to patients through SMS. International travelers and immigration officers use this system.	Case management, contact tracing, coordination and operations, diagnostic tools, event-based surveillance, laboratory systems, One Health, points of entry, risk communication and community engagement, routine surveillance, supply chain, vaccine delivery and planning	CDC, DHIS2, Gavi, MOHFW, Norad, The Global Fund, UNICEF, UNFPA	DGHS of MOHFW, HISP Bangladesh Foundation, MOHFW, UNICEF, Univesity of Oslo	Open source	National
CMED Health	CMED is a smart health monitoring system. CMED uses smart medical sensors connected to a smartphone for measurement of vital signs and stores data to its secured cloud server. Users receive instant feedback about their health status. CMED also generates health records that help doctors reduce diagnostic time and to provide better treatment.	Case management, diagnostic tools				
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	IDRC	BRAC, BRAC's James P Grant School of Public Health, CRS, IRC	Open source	Subnational
Computer Aided Detection for COVID-19 (CAD4COVID)	CAD4COVID is an AI software that triages suspected COVID-19 cases on chest X-ray or CT images. CAD4COVID supports triaging COVID-19 suspected cases, provides additional information to clinicians, and helps clinicians in determining the next step in a patient's care, particularly in resource-constrained settings and high prevalence areas. Within 20 seconds, CAD4COVID produces three outputs: (1) a score between 0 and 100 indicating the extent of COVID-19-related abnormalities, (2) a display of lung abnormalities through a heat map, and (3) percentage of visible lung tissue that is affected. Users (e.g., health facilities) can access the images and display the CAD4COVID results and color overlay on the browser of a connected device such as a laptop or tablet. CAD4COVID is CE certified and is the first AI software proven to perform at the same level as human expert readers to detect COVID-19-related abnormalities on chest X-ray images.	Diagnosic tools		Delft Imaging	Proprietary	National
Coronavirus (COVID-19) Situation in Bangladesh 2020	This dashboard visualizes the COVID-19 situation in Bangladesh. The dashboard includes the number of confirmed cases, deaths, and recoveries and the number of persons tested, quarantined, and isolated in the country.	Risk communication and community engagement		GroupMappers, MORU Epidemiology		National
Esri Bangladesh: COVID 19 Situation Response	Esri Bangladesh is a resource website on the COVID-19 situation response in Bangladesh featuring an overview of the number of confirmed cases, deaths, and recoveries. The resources include a COVID-19 dashboard, hospital location web application, and heat map on the COVID-19 cases in Dhaka.	Risk communication and community engagement		Esri Bangladesh		National
Everwell Hub	The Everwell Hub platform covers the entire digital cascade of care and is the core digital infrastructure that officers, health workers, and patients use to support diagnosis, treatment success, and recovery from TB. The Everwell Hub supports a broad patient management ecosystem (i.e., mobile, web, SMS, IVR).	Case management, diagnostic tools, event-based surveillance, laboratory systems		Everwell, Government of Bangladesh	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
Health Call Center 16263	Health Call Center 16263 includes telemedicine services and a listing of ambulances. The call center has been adapted to enable citizens to find information about COVID-19.	Risk communication and community engagement		MOHFW		National
HealthAlert	HealthConnect enables effective health communication with patients, health providers, and the health system at large. HealthConnect has been adapted for COVID-19 to provide national messaging services on behalf of WHO and several other country governments on COVID-19-related information via individual modules such as HealthAlert, HealthCheck, and HealthWorkerAlert.	Risk communication and community engagement	GCC	Praekelt		
Maya	Maya is a mobile-based digital well-being assistant that intelligently understands user questions. Users can directly connect to experts, including doctors and therapists, to get the advice they are looking for—hassle-free and without stigma.	Case management		Maya		
MonerDaktar	MonerDaktar is an online mental health platform that gives people the opportunity to connect with their preferred psychiatrist or psychologist from any part of the country.	Case management		Telepsychiatry Research and Innovation Network Ltd		National
Open Data Kit (ODK)	ODK is free and open source software that helps millions of people collect data quickly, accurately, offline, and at scale. ODK has two tool suites (ODK, ODK-X) and created a strong community of users, implementers, and developers. ODK's lead developer, Nafundi, is offering support to COVID-19 response efforts, specifically to address contact tracing, decision support, community education, strategic mapping, and case management. Bangladesh uses a mobile app based on ODK/GeoODK. It recently announced its move to Esri ArcGIS for its backend platform.	Case management, contact tracing, event-based surveillance		Cadasta, mPower	Open source	
OpenCRVS	Despite the obligations of governments to register all vital events, including birth, death, marriage, divorce, and adoption, levels of civil registration in low-resource settings remain critically low. OpenCRVS is an open source software product that supports civil registration (CR) and vital statistics (VS) services in low-resource settings, and it is interoperable with other systems. It fulfills standard CRVS functions that are well understood and documented by governments and global development agencies but are not widely available in CRVS ICT solutions. It is used by CHWs to declare births and deaths and by civil registration staff from field workers to registrars to senior management, and it provides vital statistics information for policymakers.	Case management	Digital Square, Plan International	Government of Bangladesh, Jembi Health Systems, mPower, Plan International Bangladesh	Open source	Subnational
OpenMRS+ (Bahmni)	Bahmni is an open source, electronic medical records 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 workers 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. 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. Currently in Bangladesh, Bahmni, a ThoughtWorks-developed distribution of OpenMRS, is being used as the clinical system at sub-district and district hospitals, and as a cloud-hosted CHW application at community clinics. This special distribution of OpenMRS is popularly called OpenMRS+ in Bangladesh health systems as it is a total hospital management solution incorporating OpenMRS and others. Bahmni released a COVID-19 kit that uses an OpenMRS module initializer to install forms that capture travel history and contract tracing, enable patient screening, and track information on home quarantining.	Case management, diagnostic tools, event-based surveillance, health facility and provider administration, laboratory systems, supply chain	Government of Bangladesh	Crystal Technology	Open source	National
RapidPro	RapidPro is a free and open source framework designed to send and receive data using basic mobile phones, manage complex workflows, automate analysis, and present data in real time.	Risk communication and community engagement, routine surveillance		mPower	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
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, Merck for Mothers, UNFPA	HOPE Foundation, UNFPA Bangladesh	Proprietary	Subnational
Surakṣā	Suraksa is a custom-built app maintained by the government for the use of vaccine delivery and planning.	**Risk communication and community engagement, vaccine delivery and planning**		Government of Bangladesh		
World Continuing Education Alliance	This learning management system is a multifield eLearning and mHealth system that supports virtual and blended learning linked to certifications for professional development and lifelong learning. Examples of content include modules about nursing and midwifery and COVID-19 (both clinical and nonclinical). The platform generates reports on study habits and data of users (i.e., age, gender, location, qualification, role, employment status).	**Learning and training**		Regulatory body	Proprietary	National
Amplio Talking Book	The Amplio Talking Book is a rugged, battery-powered audio device for low-literate adults and youth. Governments and development organizations use Amplio 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. This tool can be adapted to send out COVID-19-related messages in local languages.	**Risk communication and community engagement, learning and training**	Arm, CARE International, EU	Amplio, CARE International	Open source	Subnational
CAD4TB	The CAD4TB software is designed to help non-experts detect and diagnose TB more accurately and cost-effectively by combining the speed and low costs of digital X-rays with machine learning and big data. Delft's OneStopTB clinics use CAD4TB and can reach remote, and frequently underserviced, areas with ease. Delft supplies two X-ray modalities for existing (mobile) clinics.	**Diagnostic tools**		Delft Imaging	Proprietary	
Cadasta platform	Cadasta provides a common global platform and set of technology and training tools that allow local organizations, government entities, and communities to document and map land and occupants in a more quick, efficient, and affordable way. Cadasta uses an Esri-based suite of best-in-class tools and technologies that take the land-related data and migrate it into government systems. To best support community resilience in the face of COVID-19, Cadasta is providing consistent and cohesive community-level data concerning resources for response efforts, including medical clinics, pharmacies, hospitals, testing sites, and other treatment centers. The Cadasta platform is designed to be lean, agile, and easily configured for communities to use in response to a multitude of evolving needs, including those related to COVID-19 response.	**Routine surveillance**		Cadasta	Proprietary	
ColdTrace	ColdTrace is a wireless remote temperature monitoring solution designed for vaccine refrigerators in rural clinics and health facilities. The impact of COVID-19 on lifesaving immunization services has highlighted the need for a resilient cold chain system that can serve both routine and emergency vaccination going forward. This is possible by having end-to-end visibility into the country's vaccine cold chain network and ensuring data on fridge performance, power, and connectivity are available to the MOHFW in real time through ColdTrace. ColdTrace has partnerships with seven national governments and is active in 17 countries. Nexleaf Analytics has connected cold chain equipment from more than 16,822 health facilities and trained more than 1,400 health workers to respond to cold chain failures.	**Supply chain, vaccine delivery and planning**	GCC	Nexlead Analytics	Proprietary	

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

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

Digital health tool	Purpose	Use case(s)	Funder(s)	Implementer(s)	Licensing	Scale
GxAlert	GxAlert is a digital platform that facilitates country-level surveillance of viral load laboratory tests by allowing data to flow across the health system. GxAlert can connect to other electronic tuberculosis (eTB) managers or M&E systems. GxAlert can also send targeted SMS alerts to facility managers, health officers, and suppliers. GxAlert enabled a solution to address the following gaps: (1) device management, monitoring, and reporting; (2) calibration, maintenance, and procurement planning; (3) lab technologists' capacity, availability, and training; (4) real-time results notifications to respective stakeholders including rapid case notifications for all positive results to all relevant health care officers; and 5) inventory management and notifications to reduce stockouts and expires.	Coordination and operations, laboratory systems	USAID	Challenge TB, IRD, KNCV, MSH, NTP, SystemOne	Proprietary	National
KoBoToolbox	Quickly collecting reliable information in a humanitarian crisis—especially following a natural disaster such as a large earthquake or a typhoon—is the critical link to saving lives. Understanding the population's needs is often neglected for lack of quick means to gather and analyze this crucial information. KoBoToolbox is an open source suite of tools for data collection and analysis in humanitarian emergencies and other challenging environments built to address this gap.	Event-based surveillance	Digital Square, UNICEF, USAID, World Bank	FHI 360, HISP, MOHFW	Open source	National
MEDSINC Clinical Decision Support Tool	The MEDSINC platform is a web browser–based clinical severity assessment, triage, treatment, and follow-up recommendation platform developed with physician-based Bayesian pattern recognition logic. It is currently being implemented by community organizers working in the Rayer Bazar slum region in a catchment area serving approximately 30,000 individuals, including 7,000 children. Community organizers provide health education, assess for danger signs, and refer program beneficiaries to local health facilities. Through the use of MEDSINC, implementing partners are able to supervise staff, monitor progress, and capture community level public/population health data in real time.	Case management, diagnostic tools, event-based surveillance		Save the Children International, THINKMD	Proprietary	Subnational
Open Smart Register Platform (OpenSRP)	OpenSRP is an offline-capable open source mobile health platform built to enable data-driven decision-making at all levels of the health system. OpenSRP supports the health worker to prioritize point-of-care tasks, track service delivery, and simplify reporting. OpenSRP has been used to build localized applications for reproductive, maternal, newborn, child, and adolescent health; immunization; early childhood development; malaria rapid diagnosis and management; and tuberculosis treatment management.	Case management, contact tracing, diagnostic tools, event-based surveillance, health facility and provider administration, infection prevention and control, laboratory systems, learning and training, routine surveillance, supply chain, vaccine delivery and planning	BRAC USA, Goldsmith Foundation, UNICEF	BRAC Bangladesh, mPower Social, UNICEF	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 (diagnostic tools) and to report data out efficiently to DHIS2 for public health surveillance.	Case management, event-based surveillance, vaccine delivery and planning	FCDO, GIZ	HISP Bangladesh Foundation, MOHFW, mPower	Open source	Subnational
Simprints	Simprints deployed biometric IDs on health and humanitarian projects to increase health care visits and quality while preventing fraud. The biometric innovation solves challenges to immunization coverage by linking children to health records through their fingerprints. The Simprints scanner scans fingerprints and hooks up to a mobile phone. In Bangladesh, Simprints' mobile identification system has been integrated into the Manoshi Android mHealth app. CHWs were trained on how to use these tools for maternal health visits to enroll and identify expectant and new mothers and quickly and accurately access their health records. A pilot study conducted in poor neighborhoods in Dhaka found the biometric approach increased the number of women getting regular maternal health care by 38%. Simprints expects to reach 1 million mothers and children across Bangladesh by 2022.	Case management, vaccine delivery and planning	FCDO, Gates Foundation, Saving Lives at Birth: Grand Challenge for Development	BRAC, Simprints	Proprietary	
True Cover: Localized, Accurate Immunization Coverage	True Cover provides high-resolution satellite images, spatial sampling statistics, and mobile data collection to better calculate local immunization coverage in Bangladesh.	Vaccine delivery and planning				
VigiFlow	VigiFlow is a management system for recording, processing, and sharing reports of adverse effects for medical products. VigiFlow enables maximum local control and provides an effective means for management review and analysis of national data. VigiFlow has a medicine track and trace system that will ensure that all medical products and health technologies in the market have a tracing number. VigiFlow serves as the Bangladesh national database for adverse event management and keeps track of all adverse event reports nationwide.	Laboratory systems			Open source	National

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

At a glance

Figures 2 shows that Bangladesh's digital health tools rely on different software licensing types for sustainability with open source being the most common. Figure 3 demonstrates that Bangladesh has 18 digital health tools deployed on a national scale while 13 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 many of these tools in Bangladesh. These figures are not specific to COVID-19 response, but they provide an overall picture of Bangladesh's digital health infrastructure.

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

Proprietary
22%

Open source
47%

Unspecified
31%
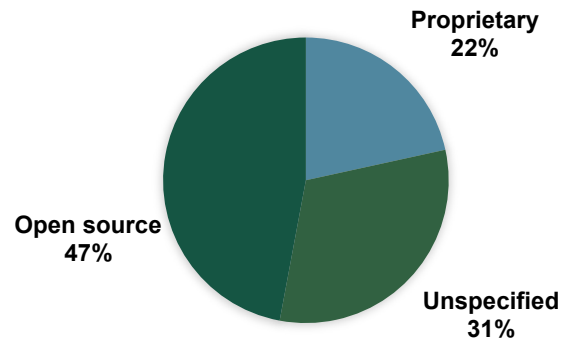
Figure 3. Number of digital tools deployed at scale in Bangladesh.

National	Subnational	Unspecified
18	13	20
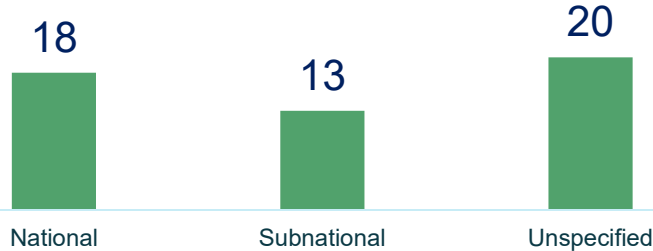
Conclusion

Digital Square mapped 51 existing, adaptable digital health tools in Bangladesh 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 Bangladesh'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 Bangladesh'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 Bangladesh's digital health systems** and their role in the COVID-19 response by reviewing Bangladesh'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.
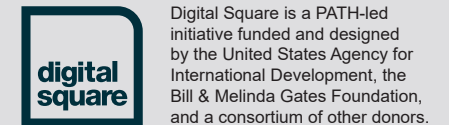
☑ **Connect with additional relevant resources, including:**

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
AI	artificial intelligence
CDC	Centers for Disease Control and Prevention
CHW	community health worker
CRS	Catholic Relief Services
CT	computed tomography
DGHS	Department of Global Health Security
DHIS2	District Health Information Software 2
EU	European Union
FCDO	UK Foreign, Commonwealth & Development Office
Gavi	Gavi, the Vaccine Alliance
GCC	Grand Challenges Canada
GIS	geographic information system
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HiSP	Health Information Systems Programme
HMIS	health management information system
ICT	information and communications technology
ID	identification
IDRC	International Development Research Centre
IRC	International Rescue Committee
IRD	Interactive Research and Development
IRV	interactive voice response
KNCV	KNCV Tuberculosis Foundation
M&E	monitoring and evaluation
MOHFW	Ministry of Health and Family Welfare
MORU	Mahidol Oxford Tropical Medicine Research Unit
MSH	Management Sciences for Health
Norad	Norwegian Agency for Development Cooperation

Acronym	Definition
NTP	National Tuberculosis Program
ODK	Open Data Kit
OpenMRS	open source medical records system
OTP	one-time password
SMS	short message service
TB	tuberculosis
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Annex 2. Use case definitions

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

Annex 3. Digital tools supporting vaccine deployment

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

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

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

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

Description of vaccine deployment use cases	Digital Square approved global goods use cases
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.	💬 **Messaging**
	⊙ **Microplanning**
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**
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.	
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.	📱 **Patient monitoring**
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.	🌐 **Supply chain**
	💉 **Vaccine management**
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.	

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.