

# PMI Digital Community Health Initiative Cross-Country Landscape Report

Understanding the Use of Digital Technologies  
in Community Health Programs



**PMI**

U.S. PRESIDENT'S  
MALARIA INITIATIVE

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For more information on Digital Square, please visit our website at [www.digitalsquare.org](http://www.digitalsquare.org) or email [digitalsquare@path.org](mailto:digitalsquare@path.org).

For more technical information on Digital Square–approved global goods, please visit our wiki at [wiki.digitalsquare.io](http://wiki.digitalsquare.io).

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U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES

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This global report was authored by Emily Carnahan (PATH) with input from and review by (alphabetically) Sarah Burnett (PATH), Skye Gilbert (PATH), Rodrigo Gramajo (PSI), Ala'a Kolkaila (PATH), Monica Kothari (PATH), Lauren Lewis (PMI), Annë Linn (PMI), Christopher Lourenço (PSI), Zahra Lutfeali (PATH), Lorina McAdam (PSI), Jed Meline (PMI), Nathaniel Moller (PMI), Henry Mwanyika (PATH), Ayano Ogawa (PATH), Dean Sayre (PMI), Kammerle Schneider (PATH), and Anzel Schonfeldt (PATH). Jen Fox (Atomic Fox Design) designed the report layout and graphics.

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## Key acronyms

<b>ANC</b>	antenatal care
<b>CCM</b>	community case management
<b>CHW</b>	community health worker
<b>DATEC</b>	Digital Applications and Tools Across an Epidemiological Curve
<b>DHIS2</b>	District Health Information System 2
<b>DRC</b>	Democratic Republic of the Congo
<b>EPI</b>	Expanded Program on Immunization
<b>HIS</b>	health information system
<b>HMIS</b>	health management information system
<b>iccm</b>	integrated community case management
<b>ICT</b>	information and communications technology
<b>LLIN</b>	long-lasting insecticide-treated net
<b>MIS</b>	malaria information system
<b>MOH</b>	Ministry of Health
<b>PMI</b>	U.S. President's Malaria Initiative
<b>PSI</b>	Population Services International
<b>SOP</b>	standard operating procedure
<b>USAID</b>	U.S. Agency for International Development
<b>WHO</b>	World Health Organization

# Executive summary

Globally, there is growing recognition of, and investment in, the important role of community health workers (CHWs) in preventing and treating malaria and other febrile illnesses. At the same time, innovations in digital technology and expanded access to mobile phones provide an opportunity to leverage digital health tools to strengthen service delivery at the community level. Digital health tools in the hands of CHWs can improve the quality of care through decision support, increased access to health data, more efficient workflows, and closer communication with peers and supervisors. The strategic use of digital tools to support integrated service delivery—down to the community level—is critical to maximize impact in the fight against malaria and other febrile illnesses.

In 2020, the U.S. President's Malaria Initiative (PMI) launched its Digital Community Health Initiative with a vision to strengthen the quality of health care delivery at the community level in PMI partner countries by investing in the scale-up of digitally enabled community health platforms. To inform the initiative, PMI partnered with Digital Square at PATH to conduct a malaria digital community health assessment in PMI's 27 partner countries. While this assessment focused on malaria, the findings can be used to understand the broader digital ecosystem at the community level to support integrated service delivery. This report provides a cross-country synthesis of findings and presents recommendations for PMI, its partners, local actors, and other donors to advance the use of digital tools to support community health programs.

## Methods

Digital Square implemented a mixed-methods approach that relied on secondary data review, primary data collection, and stakeholder engagement. To first identify and understand the digital ecosystem at the community level in each country, Digital Square conducted an ecosystem assessment that included a desk review, a survey on digital tools in use, and interviews with national and subnational stakeholders. Participatory stakeholder workshops were held to validate results from the initial assessment and identify recommended actions. Information was analyzed across the 27 countries to identify cross-country trends, opportunities, and priorities and generate global recommendations.

The Digital Health for Community-Based Management of Febrile Illness framework was used to guide data analysis and recommendation development. Digital Square developed this framework as part of this assessment to describe the desired state for CHW use of digital tools for managing malaria and other febrile illnesses. The framework focuses on management of febrile illness, acknowledging that malaria case management should be included within an integrated community case management (iCCM) approach. The framework provides an overview of key components necessary for expanding the use of digital technologies at the community level; these components fall into three domains:



### PEOPLE

personnel, training,  
and technical support



### GOVERNANCE

policies, strategies, and governance  
structures and their implementation



### SYSTEMS

data flow, digital tool structures,  
functionalities, and use

Findings and recommendations are categorized according to the three domains: people, governance, and systems.

# Current state of digital community health



## PEOPLE: CURRENT STATE

“People” highlights the CHWs, supervisors, information technology support staff, and other decision-makers who contribute to the effective use of digital tools and data in malaria community health programs. Across countries, common challenges for CHW programs include a shortage of CHWs to meet community health needs; the status of CHWs as nongovernmental employees who are not paid a salary, which can influence performance and retention; limited use of digital tools and data among CHWs; and use of data collected by CHWs for, primarily, reporting to higher levels of the health system rather than for decision-making at the community level.

A strong CHW program is necessary to successfully operationalize digital health; in turn, digital tools can be used to strengthen CHW programs and service delivery. Digital tools can collect information about CHWs—who they are, where they are deployed, and how they are performing—to inform supportive supervision and workforce planning. Where CHWs are paid, digital financial services can be used to facilitate efficient mobile payments. Digital tools can provide a platform for CHW trainings, peer learning and engagement, and forums for deliberate skill building and on-demand learning. Digital tools can connect CHWs with their communities and supervisors to strengthen feedback loops. And digital tools can provide CHWs with access to data about their community to make data-driven decisions, which can drive CHW motivation and performance. Overall, digital tools can support CHWs to improve the quality of care they provide.

27/27

countries with active CHW programs

17/27

countries where CHWs are not government employees and not paid a salary

16/27

countries with 10 or fewer CHWs per 10,000 people



## GOVERNANCE: CURRENT STATE

“Governance” describes the national strategies and policies that provide the framework for community health programs’ use of digital tools for high-quality service delivery, as well as the implementation status of those strategies and policies. Nearly all countries have a current malaria strategic plan (n = 26), and most have a current community health strategic plan (n = 20). Nearly two-thirds of countries have a current national digital strategy (n = 17). Most of these strategies include a funding strategy to support operationalization. Digital health strategies, where they exist, have not been fully implemented. Many countries do not have policies or processes in place to operationalize their digital health strategies, such as guidelines for standards and interoperability, laws on data security or privacy, or health worker standard operating procedures on data use. Challenges to implementing the digital health strategies include siloed systems, lack of enterprise architecture, no clearly articulated policies or implementation plans, and limited funding. Leadership and political will are strong drivers of digital transformation. A common enabler of implementation is that many countries have established coordinating/governing bodies for digital health that have a scope of work or terms of reference and meet regularly. As countries operationalize their digital health strategies, there is an opportunity to focus on alignment between malaria, community health, and digital health strategies.

26/27

countries have a current national malaria strategy

20/27

countries have a current national community health strategy

17/27

countries have a current national digital health strategy



## SYSTEMS: CURRENT STATE

“Systems” describes the processes and digital tools that enable community health platforms to effectively use digital technology and data to strengthen malaria and other health programs. CHW data are captured in a mix of paper-based and digital tools. Some countries, like the Democratic Republic of the Congo, capture nearly all community data through paper-based tools filled out by CHWs, whereas in other countries, like Cambodia, CHWs capture malaria case data electronically using mobile devices. Most countries fall somewhere in between, having historically relied on paper-based forms and now piloting or scaling various digital health tools for community data collection. Across countries, dozens of digital tools are used by CHWs, although few are scaled nationwide. In most countries (n = 21), a subset of CHWs are currently using at least one tool to provide malaria community case management (CCM). Introducing multiple digital tools can lead to fragmentation if they are not aligned to common standards or connected to the health management information systems. Stakeholders in many countries have identified the need to support integration and interoperability of digital tools and existing systems. In addition, the subnational availability of electricity and mobile connectivity are limited in many countries, which should be considered when selecting or designing tools for the existing ecosystem.

### Global recommendations

Below are ways that PMI, its partners, local actors, and other donors should support country governments to strengthen their community digital health systems, based on gaps, lessons learned, opportunities, and promising innovations identified across the 27 PMI partner countries.

**21/27**

**countries with CHWs  
that use digital tools to  
provide malaria CCM**

**18/27**

**countries with less  
than 25% of rural areas  
having electricity**

**15/27**

**countries with a priority of  
focusing on integration and  
interoperability of digital tools**



## PEOPLE: RECOMMENDATIONS

Investing in the community health workforce is necessary to successfully operationalize digital health. Enough CHWs should be available and deployed to support high-priority at-risk communities. CHWs should have adequate skills and literacy to use digital tools for iCCM. They also should be integrated as a valued aspect of the national health system. Digital tools can help support the training, quality of service, and reach of the community health workforce and can play a role in supporting efficient investments in workforce development. With a strong workforce in place, data generated by CHWs can be used by CHWs and across all levels of the health system to reduce the burden of febrile illnesses. Recommendations to achieve these include the following:

- Center the end-user needs of CHWs and the communities they serve to inform the design and use of digital tools for community-based interventions. Participatory, in-depth assessments can improve understanding of user needs, availability, capacity and skills, geographic location, and administrative reporting lines.
- Enhance motivation and performance of CHWs through strengthening (1) supportive systems, (2) professional development and training opportunities, and/or (3) community accountability.
- Support country governments to pay CHWs for their time and services, leveraging digital tools for efficient mobile payments if necessary, and assess any resulting changes in the quality of care.



## GOVERNANCE: RECOMMENDATIONS

National malaria, community health, and digital health strategies and governance agendas should be driven by local government ownership/sponsorship to ensure local advocacy and sustainability. These strategies should be costed, funded, implemented, and updated regularly under the stewardship of local governments. National digital health and community health strategies should be aligned and support each other, and government authorities should lead and own the coordinated implementation of these strategies. Furthermore, strategies for malaria and other health areas should align with digital health and community health strategies to strengthen integration at the community level. Recommendations to achieve these include the following:

- Support country governments to lead the implementation of digital health and community health strategies, and use the implementation process to coordinate and identify synergies across different strategies. Governments should engage CHWs and other relevant stakeholders—for example, through multidisciplinary technical working groups or coordination bodies.
- Collaborate with global and/or regional institutions to review and contextualize global standards and support the implementation of standards in PMI partner countries.
- Document and disseminate learnings and promising practices from country experiences in operationalizing digital health strategies.



## SYSTEMS: RECOMMENDATIONS

Countries should have a clear vision for their national digital health information system and ecosystem that includes data flows between CHW source data and national data warehouses. Digital health tools should be sustainable, adaptable, aligned to national interoperability standards, used where needed, and designed with the end user. They also should have functionalities to support CHW febrile illness management and data-driven decisions. Recommendations to achieve these include the following:

- Explore new types of partnerships, such as with local organizations or the private sector, to strengthen the digital health ecosystem and improve the sustainability of digital health systems.
- Define and implement country-specific enterprise architecture that includes a long-term vision for health information systems, including their ability to support integration of the full package of health services that CHWs deliver.
- Advance the interoperability of tools and systems—across disease verticals and levels of the health system—to streamline data collection and management and improve opportunities for data use.
- Invest in global goods that are frequently used for iCCM and CHW management, and support countries to scale these digital tools.



# Introduction

Globally, there is growing recognition of, and investment in, the important role of community health workers (CHWs) in preventing and treating malaria and other febrile illnesses. At the same time, innovations in digital technology and expanded access to mobile phones provide an opportunity to leverage digital health tools to strengthen service delivery at the community level. Digital health tools in the hands of CHWs can improve the quality of care through decision support, increased access to health data, more efficient workflows, and closer communication with peers and supervisors. The strategic use of data to guide the deployment of health services and interventions—down to the community level—is critical to maximize impact in the fight against malaria and other febrile illnesses.

While every country's digital health ecosystem is unique, each is dependent on a common set of building blocks.<sup>1</sup> These building blocks are enablers that can maximize the benefits of digital technology and data to improve health systems and health outcomes—from national to community levels. The figure below shows how the digital ecosystem can enable the use of digital tools and how digital tools in the hands of CHWs can add value to community health programs in many ways.

## DIGITAL HEALTH ECOSYSTEM BUILDING BLOCKS

**Leadership and Governance**, including whether the country has a national governing body for digital health

**Strategy and Investment**, including whether the country has a digital health strategy and a costed digital health plan

**Legislation, Policy, and Compliance**, including whether the country has laws or policies for data protection, data privacy, and data sharing

**Workforce**, including whether the country has digital health trainings and a digitally literate workforce

**Standards and Interoperability**, including whether the country has a national digital health architecture and/or health information exchange and health information standards

**Infrastructure**, including the country's network readiness and digital health infrastructure (e.g., equipment/hardware)

**Services and Applications**, including whether country priorities are supported by scaled digital health systems and whether there are digital identity management systems for health



## POTENTIAL ADDED VALUE OF DIGITAL TOOLS

- **Improve the quality of care** by providing decision support to guide CHW service provision
- **Improve the timeliness of data** and their use by making them immediately accessible once they have been synced to a central database, preventing the need to wait for monthly reports
- **Improve access to data by CHWs**, through the mobile tool itself, as well as by staff at other levels of the health system through dashboards
- **Save health worker time** by replacing manual, paper-based data aggregation and reporting with automated reporting and analytics
- **Improve stock management and reduce stockouts** of diagnostic tests and treatments, such as antimalarials and amoxicillin, with stock planning and forecasting functionality
- **Improve CHW management and supervision** by uniquely identifying CHWs and their link to the health system, capturing CHW performance analytics, and providing two-way communication between CHWs and supervisors
- **Increase CHW motivation** by empowering them to use data and creating closer connections with peers and supervisors
- **Strengthen the data use culture** that encourages data-driven decision-making and continuous quality improvement



## PMI's Digital Community Health Initiative

Investing in stronger community health platforms is an ongoing priority for the U.S. President's Malaria Initiative (PMI). As a component of this priority, PMI believes that digital tools in the hands of CHWs and frontline health care providers have tremendous potential to increase the impact of programming for malaria and other febrile illnesses. Additionally, this will strengthen global health security by building community-level platforms for novel fever and disease detection.

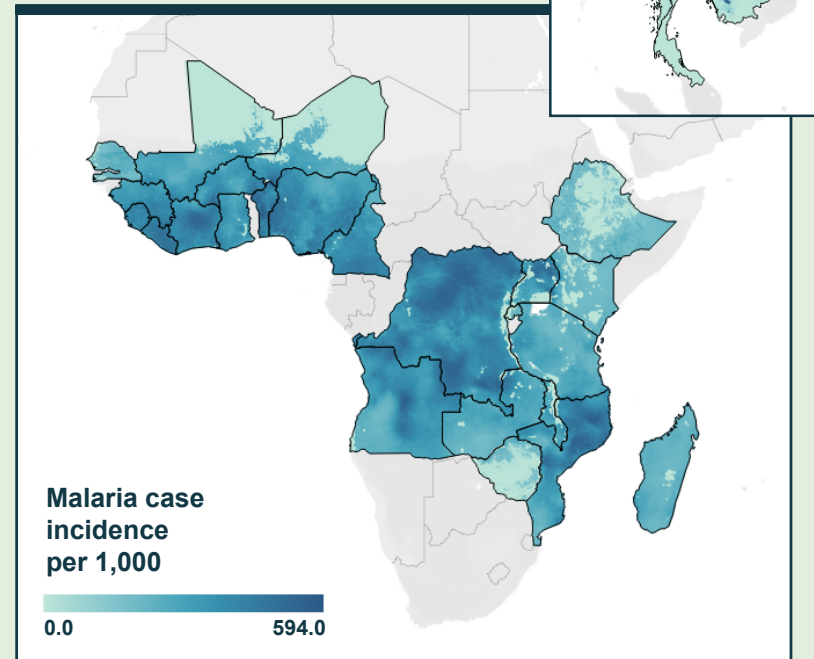
In 2020, PMI launched its Digital Community Health Initiative with a vision to strengthen the quality of health care delivery at the community level in PMI partner countries by investing in the scale-up of digitally enabled community health platforms that:

- Equip frontline health workers with connected mobile tools to increase the effectiveness of equitable case management (e.g., job aids, diagnostic tools/readers, support in encouraging care-seeking behaviors).
- Improve access to near real-time, high-quality community data that flow directly into country health information systems (HISs) at the most peripheral level.
- Strengthen the culture of using community data for decision-making across all levels of the health care system.
- Facilitate the integration of services at the community level in alignment with the holistic needs and health goals of each country.
- Integrate CHWs as a valued aspect of the national health system.

Although the use of digital technologies to support community health programs is increasing, it differs by and within countries. There is limited information on which tools are being used where and little guidance regarding best practices for implementation of integrated community case management (iCCM) programs that incorporate digital technologies. There is an opportunity to better understand current systems, share best practices, and identify opportunities for integration.

## About PMI

**The U.S. President's Malaria Initiative** (PMI) supports countries and partners in Africa and Southeast Asia to reduce malaria deaths and decrease malaria morbidity, with a long-term goal of malaria elimination. PMI works with national malaria programs and partners to scale proven interventions, adapt to changing epidemiological contexts, improve countries' capacity to collect and use information, mitigate risk against the current malaria control gains, and build capacity and health systems. In collaboration with its partners, PMI has contributed to saving 7.6 million lives and preventing 1.5 billion malaria infections since 2000.<sup>2</sup>



Malaria subnational case incidence per 1,000 people in PMI's 27 partner countries. Data source: Malaria Atlas Project, 2019. <https://malariaatlas.org/>.

## Malaria digital community health assessment

As an initial step to support the Digital Community Health Initiative, PMI partnered with Digital Square at PATH to engage various stakeholders—from the ministry level to CHWs, donors, implementers, and other important stakeholders—to understand the current digital environment and to define country-specific priorities for using digital technology in community health programs. Digital Square implemented a phased approach in PMI's 27 partner countries to first identify and understand the digital ecosystem at the community level and then prioritize opportunities for improvement, which can inform implementation and investments to address the identified gaps. To guide the assessment, Digital Square developed a Digital Health for Community-Based Management of Febrile Illness framework (described further on page 12) that considers the digital health ecosystem from the CHWs' perspective, particularly with regard to managing febrile illnesses.

This report describes the methodology for the malaria digital community health assessment and provides a cross-country synthesis of findings from the identification and prioritization phases. While each country is unique in its disease burden, digital ecosystem, community health programming, and overall context, this report identifies common gaps, shares best practices, and highlights opportunities across countries to inform global and local investments and high-priority activities. The report closes with global recommendations for PMI and partners to advance the use of digital tools to support community health programs. While this assessment focused on malaria, the findings can be used to understand the broader digital ecosystem at the community level, and the recommendations are intended to support an integrated approach in alignment with delivery of CHW services.

### Malaria digital community health assessment phased approach

#### IDENTIFY

Understand the digital ecosystem at the community level, including how digital technologies are used in delivering malaria services.

#### PRIORITIZE

Engage PMI and national programs to prioritize opportunities for improvement.

#### IMPLEMENT

Support PMI, national programs, and partners to implement projects and address identified gaps.

## Investing in global goods

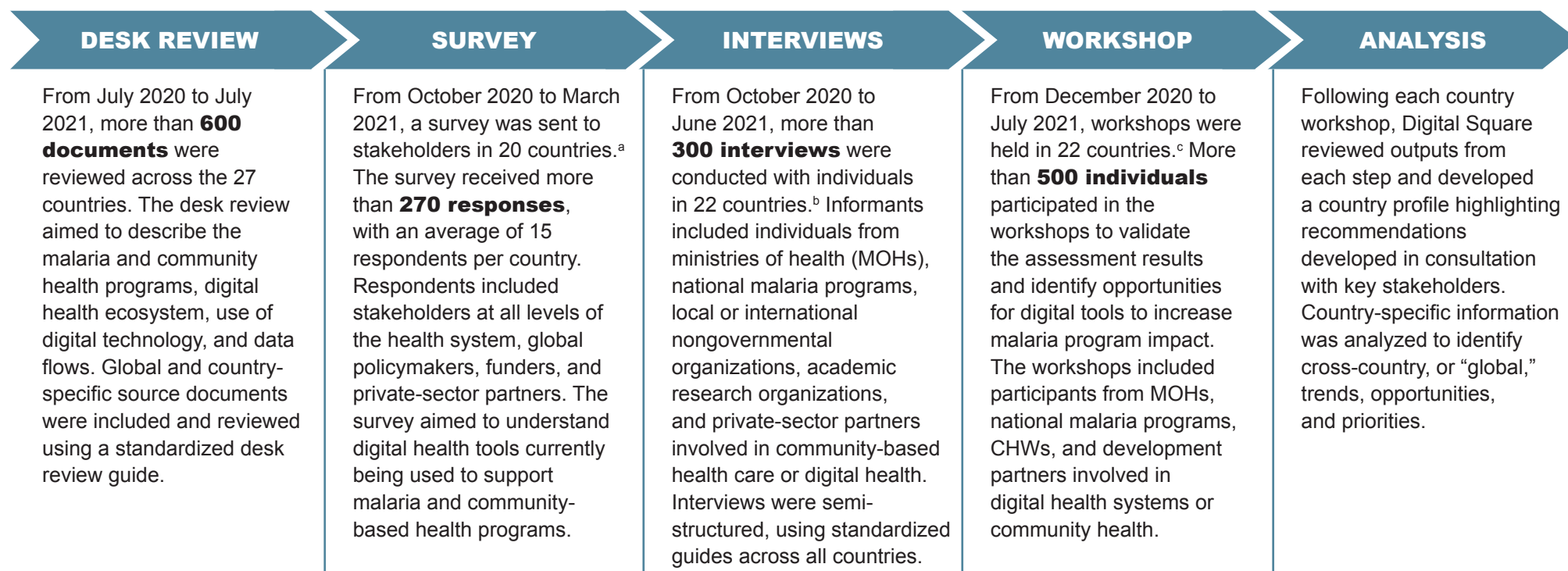
Software global goods are digital tools, often free and open source, that can be adapted and reused for the global health sector to meet the needs of various countries and contexts. Global goods can provide low-cost solutions to be implemented across health verticals. These solutions are able to integrate with and be interoperable across the country's various health management information systems. This assessment considered the use of global goods in the 27 PMI partner countries. For more information about global goods, please see: <https://digitalsquare.org/global-goods-guidebook>



Visit [digitalsquare.org/community-health](https://digitalsquare.org/community-health) to view all 27 country profiles

# Methodology

Digital Square implemented a mixed-methods approach that relied on secondary data review, primary data collection, and stakeholder engagement. To first identify and understand how digital technologies are used in community health programs, Digital Square conducted an ecosystem assessment for each country that included a desk review, survey on digital tools in use, and interviews with national and subnational stakeholders. This was intended not as a systematic research study but as an ecosystem assessment based on available information. Country-specific participatory workshops were held with stakeholders to validate results from the initial assessment and identify digital health needs, opportunities, and priorities. Information from all data sources was triangulated and synthesized to develop country-specific summaries of the current digital, malaria, and community health landscape. To inform this global report, the country-specific information was analyzed to identify cross-country trends, opportunities, and priorities. The results from this assessment are intended to be used to support PMI, national malaria programs, and partners to improve coordination and inform action to address identified gaps.



<sup>a</sup> Surveys were not conducted in Burkina Faso, Cambodia, Ethiopia, Tanzania (mainland and Zanzibar), Thailand, Zambia, and Zimbabwe due to sufficient existing documentation and/or a preference for interviews and workshops that were more feasible or contextually appropriate data collection methods.

<sup>b</sup> In lieu of interviews, consultative workshops were conducted with government and program implementation staff in mainland Tanzania and Zanzibar. Interviews were deprioritized in Burkina Faso due to sufficient documentation from recent assessments. At the time of writing, interviews had not yet started in Ethiopia, Zambia, and Zimbabwe.

<sup>c</sup> At the time of writing, workshops had not yet been held in Ethiopia, Kenya, Zambia, and Zimbabwe. In Burma, validation meetings were held with stakeholders in place of a formal workshop.

# ○ Digital Health for Community-Based Management of Febrile Illness framework

The Digital Health for Community-Based Management of Febrile Illness framework describes the desired state for CHW use of digital tools for managing malaria and other febrile illnesses—a state in which community health programs leverage digital health tools to strengthen service delivery and generate and use data that improve community health programming, with the goal of decreasing malaria morbidity and mortality and the burden of other febrile illnesses.

Digital Square developed this framework as part of this assessment to consider the digital health ecosystem from the CHWs' perspective so that digital health tools and related systems support CHWs in providing high-quality care and reduce CHWs' reporting burden. The framework was designed to focus on malaria and other febrile illnesses, including COVID-19 (see box), although the recommendations developed using this framework are intended to support an integrated approach in alignment with delivery of CHW services.

The framework provides an overview of the key components and functionalities that are necessary for expanding the use of digital technologies at the community level. The nine key components within this framework fall into the three domains:



## PEOPLE

personnel, training, and technical support



## GOVERNANCE

policies, strategies, and governance structures and their implementation



## SYSTEMS

data flow, digital tool structures, functionalities, and use

## Digital Health for Community-Based Management of Febrile Illness framework and pandemic preparedness (e.g., COVID-19)

This framework was developed to guide the use of digital tools for CHW management of malaria cases and other febrile illnesses during routine service delivery. Given that COVID-19 and other emerging pandemic threats can present as febrile illnesses, this framework also applies to many aspects of CHWs' involvement in pandemic preparedness. For example, depending on national guidelines, CHWs may play a role in testing and diagnosing suspected COVID-19 cases; providing supportive treatments for symptom management; recording information on suspected cases, confirmed cases, and contacts; carrying out contact tracing; and participating in public awareness campaigns for disease prevention and vaccination. CHWs will also need to have the necessary skills and equipment to provide these services. Each of the activities described above can be strengthened by using digital health tools that are designed to address the specific pandemic threats, such as COVID-19.

Beyond CHWs' involvement in COVID-19 management, digital tools have a role to play across the COVID-19 epidemiological curve. Additional work regarding use cases and the incorporation of digital tools for COVID-19 has been completed by the [Map & Match project](#).

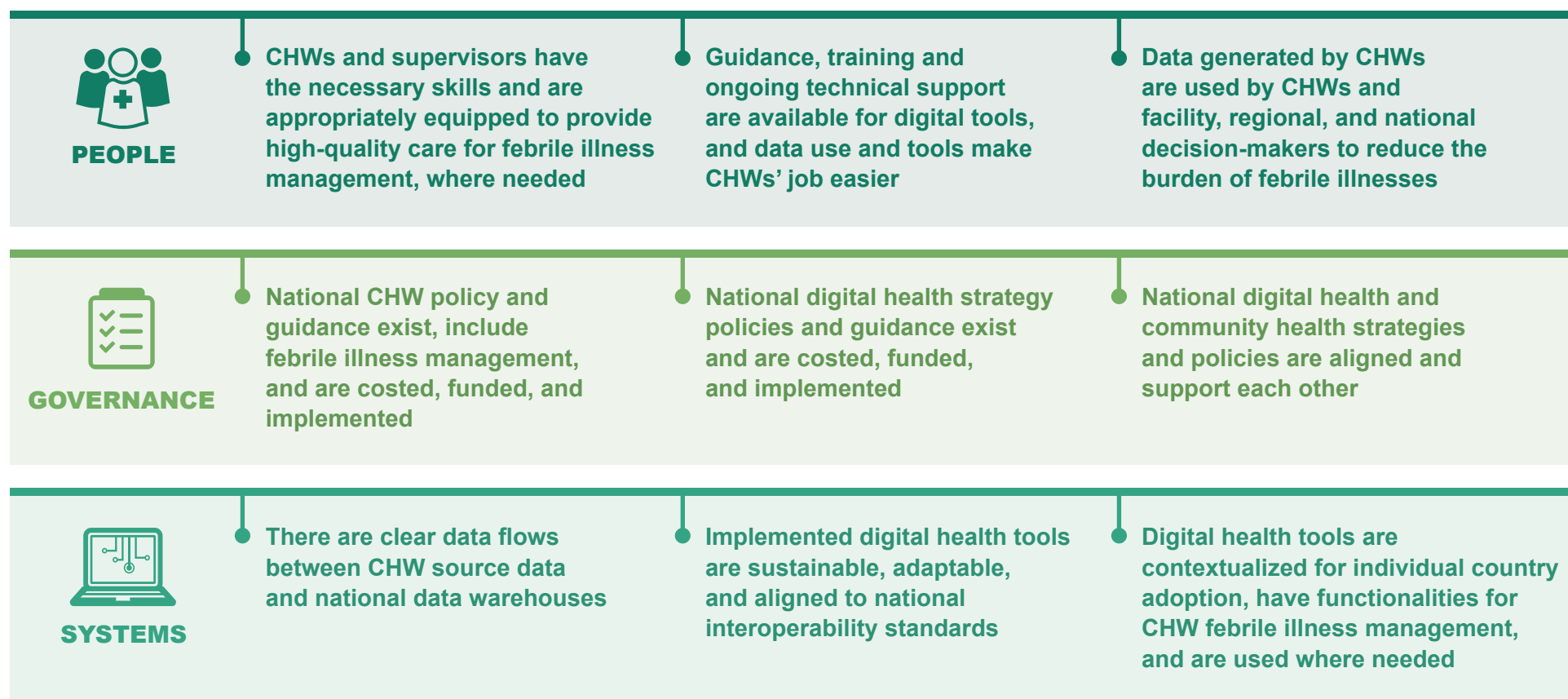
You can find more information online in the [Digital Applications and Tools Across an Epidemiological Curve \(DATEC\) framework](#).

The development of the three domains—people, governance, and systems—was informed by the digital health ecosystem building blocks (described on page 8).<sup>1</sup> The development of the components within each domain was informed by the [Digital Health Tools for Community Health Worker Programs: Maturity Model and Toolkit](#); the components for this framework were adapted to incorporate content specific to malaria and other febrile illnesses, including COVID-19. Each of the nine components is described in the figure below. These components, when combined, complement each other to achieve the desired state.

Successful use of digital health tools for community febrile illness management relies on a well-functioning national health system, robust community health and malaria programs, and a strong enabling environment for digital health. While this framework aims to provide a comprehensive overview of all aspects of the desired state, it is focused on providing more detailed recommendations regarding the adoption, use, and scaling of digital health tools for febrile illness management, acknowledging that underlying program- and system-wide challenges should be recognized and considered as part of this process.

Additional details on the framework, including illustrative recommendations related to each component and descriptions of digital tool functionalities to support malaria community health programs, can be found on the [Digital Square website](#).

### Digital Health for Community-Based Management of Febrile Illness framework components





# People

**“People” highlights the CHWs, supervisors, information technology support staff, and other decision-makers who contribute to the effective use of digital tools and data in malaria community health programs.**

**There is a growing recognition of the need for CHWs to fight malaria and other febrile illnesses. A strong CHW program is necessary to successfully operationalize digital health.**

All PMI partner countries have CHW programs; in 26 of the 27 countries, CHWs provide malaria CCM.<sup>d</sup> In many contexts, CHWs provide a range of preventive, promotive, and curative health services across disease areas to promote primary health care. In 2020, PMI supported 23 countries in providing iCCM services, which include malaria CCM.<sup>2</sup> This shift toward integrating health care delivery and strengthening community health systems aims to improve the quality and availability of services and to increase resilience against pandemics.

**27**

**PMI partner countries  
where there are active  
CHW programs**

**26**

**countries where  
CHWs provide  
malaria CCM**

**23**

**countries where CHWs  
provide iCCM services  
with PMI support<sup>2</sup>**

The scope and scale of community health programs vary across PMI partner countries (see bar chart on page 15). Niger and the Democratic Republic of the Congo (DRC) have large cadres of CHWs relative to other countries, with 640 and 200 CHWs per 10,000 people, respectively. However, fewer than 5 percent of the CHWs in the DRC provide malaria CCM.

Overall, there is not a clear relationship between malaria incidence and the number of CHWs in a country. However, there are some countries with a high malaria burden and a low number of CHWs. In these countries, there could be an opportunity to scale up the number of CHWs to support expanded access to iCCM, such as in Burkina Faso, Ghana, Malawi, Mozambique, and Nigeria (see figure on page 15).

<sup>d</sup> The exception is mainland Tanzania, where the formal cadre of paid CHWs employed by the government is limited to distributing bednets and providing social and behavior change communication. Only CHW supervisors with a clinical background are allowed to provide CCM of malaria and other febrile illnesses. However, the MOH is currently revising the national community-based health program guidelines with an eye to expanding the health services provided by CHWs.

## What is a CHW?



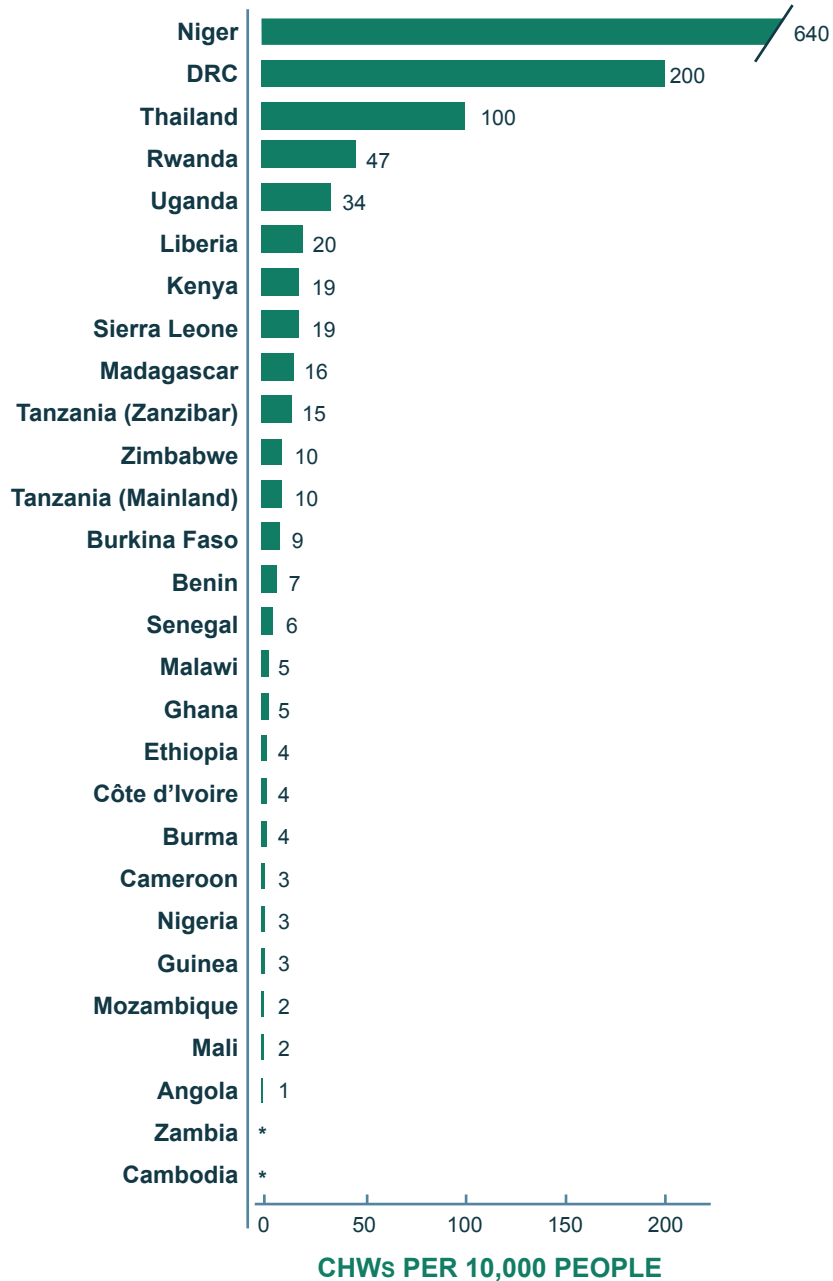
CHWs go by many names. In different contexts, they can be known as accredited social health activists, community health extension workers, community health volunteers, or village health team members, to name a few.

There are often various cadres of CHWs within a country with different levels of education and training. The range of services CHWs provide can vary by cadre, with some limited to providing behavior change communication activities and others delivering packages of preventive and curative services. They can also vary in how and where they provide these services, with some CHWs operating out of community posts or health huts and others providing services through home care.

In this report, we use the term “CHW” to refer generally to all frontline health workers at the lowest administrative level who are dedicated to serving their local communities.

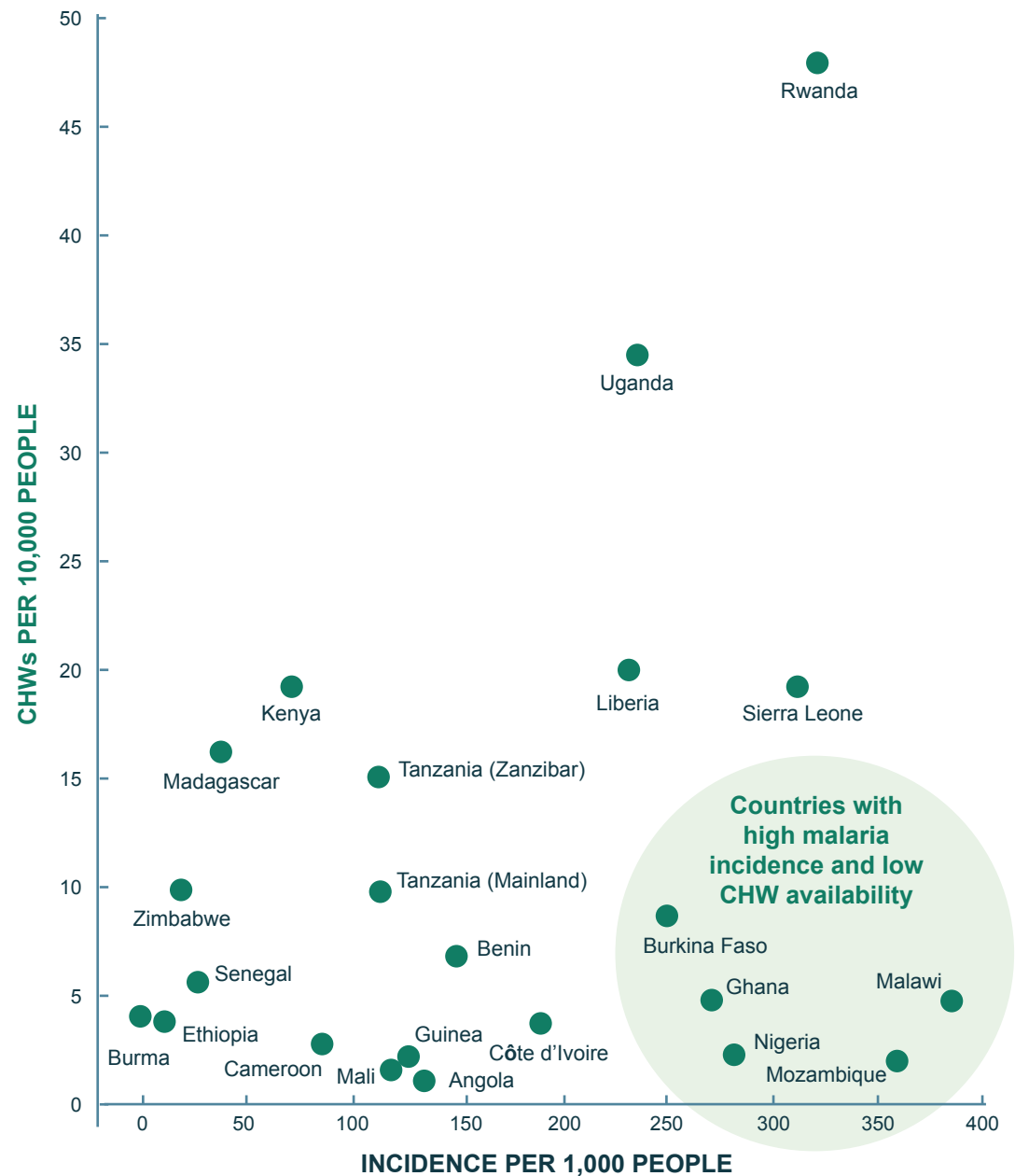
## CHW availability (per 10,000 people)

(The number of CHWs varies widely across PMI's partner countries.)



## CHW availability relative to national malaria incidence

(There may be an opportunity to scale up the number of CHWs to expand access to iCCM in countries with high malaria incidence and low CHW availability.)



For data sources, please refer to the country profiles. Asterisks indicate that data were not available.

The DRC, Niger, and Thailand are excluded from the figure on the right due to the high number of CHWs per 10,000 people.



**The shortage of skilled human resources for community health programs is a common challenge across PMI partner countries. Also, many countries do not have a national system for tracking their CHWs to know exactly how many there are, which are currently active, or where they are deployed.**

In many countries, there is a gap between the number of trained CHWs and the community health needs. In response, through this malaria community digital health assessment, stakeholders in some countries (Angola, Malawi, Mozambique, Rwanda) have recommended increasing the number of CHWs and/or the services they provide. For example, in Mozambique, there are 6,900 CHWs working across all 11 provinces, but their number is insufficient to meet the community health needs. Stakeholders recommended strengthening and expanding the CHW program, including scaling the number of CHWs (in line with the country goal of training 8,000 CHWs by the end of 2021) and expanding their catchment areas.

In most countries (n = 15), only a subset of all CHWs provide malaria CCM. Fewer than 25 percent of CHWs are currently providing malaria CCM in the DRC, Guinea, Senegal, Tanzania, Thailand, and Zimbabwe (see figure on page 17). Where a subset of CHWs provide malaria services, there is an opportunity to expand the reach of such services by training and equipping additional CHWs already active in the country to provide iCCM. For example, in Rwanda, where roughly half of all CHWs are involved in malaria-related activities, stakeholders have recommended expanding malaria service delivery at the community level by training all CHWs on the use of digital health tools and integrated community health packages.

Another approach national governments are taking is to place CHWs in underserved areas. CHWs are particularly important to improve health equity, for example, increasing access to febrile illness services for those communities with higher disease burden or reduced health facility access. For example, in Côte d'Ivoire and Liberia, CHWs are stationed in communities more than 5 km from the nearest health facility, and in Zambia, CHWs are targeted to areas with the highest need (see “Country Spotlight” box).

There is an opportunity to use digital tools to collect information about CHWs—who they are, where they are located, and how they are performing—so community health program managers have better information to provide supportive supervision and to inform workforce planning.

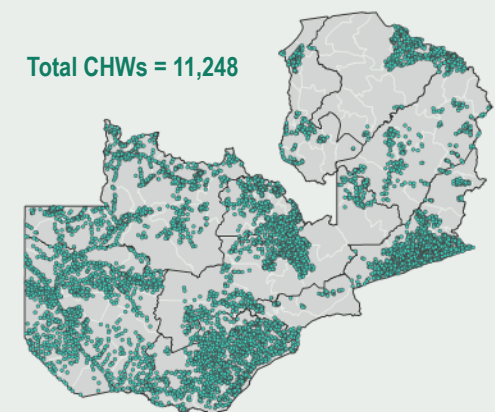
## COUNTRY SPOTLIGHT



### Zambia: Targeting CHWs to the areas with the highest need

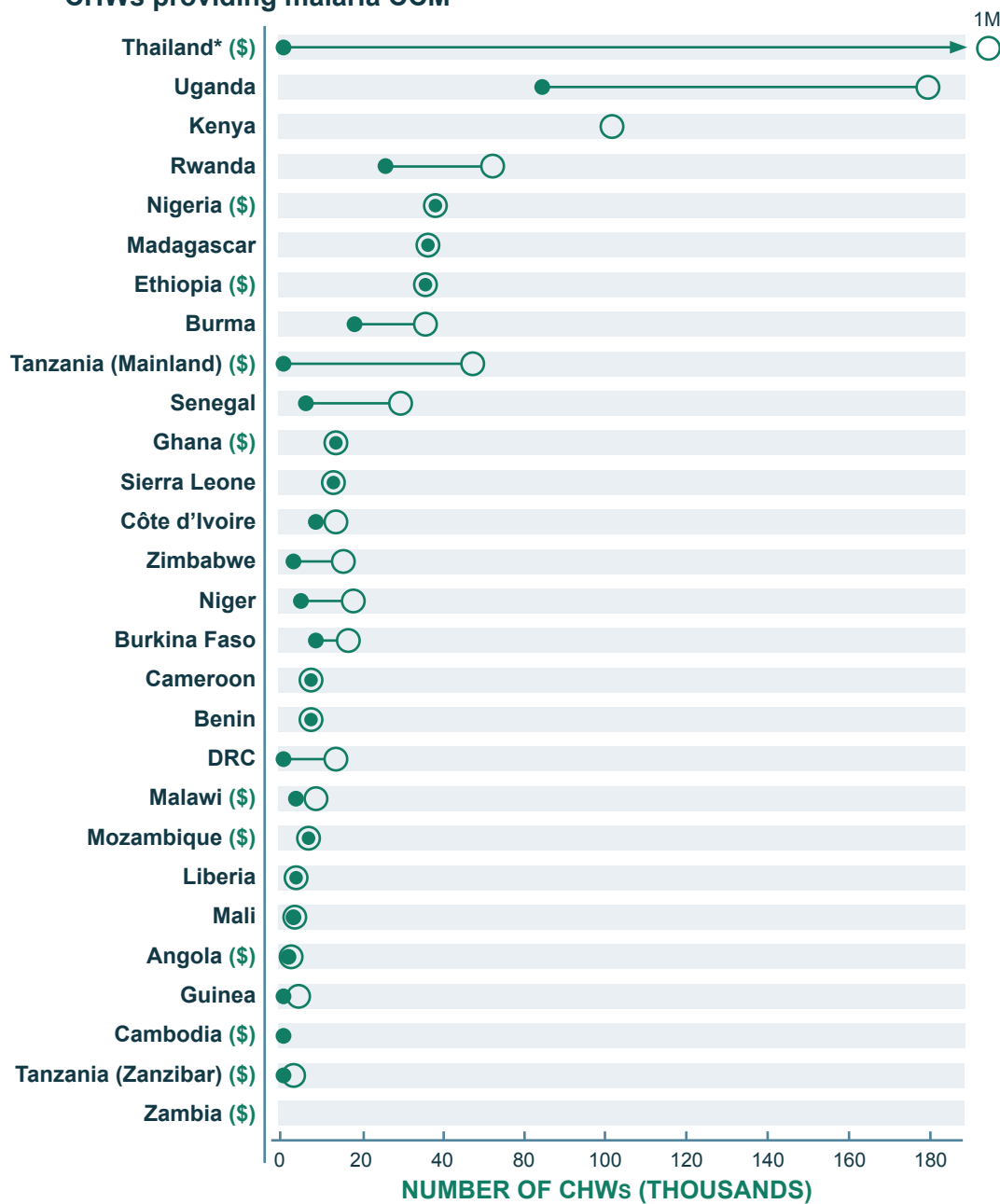
Since 2013, malaria CCM has been expanded in multiple provinces of Zambia. CHWs test and treat individuals who seek care and capture data to inform spatial surveillance. Currently, CHWs also are piloting reactive case detection in areas with low malaria prevalence when an individual has a positive rapid diagnostic test.

Stakeholders are increasingly using data to drive decisions about where to locate CHWs based on community needs, including malaria incidence rates, population density, facility access, and the distance people travel to seek care. The National Malaria Elimination Centre's District Health Information System 2 (DHIS2) captures data on the geolocation of more than 11,000 CHWs so decision-makers have information on how many CHWs there are and where they are deployed. The figure below shows the concentration of CHWs in underserved communities across the country.



Data source: Zambia National Malaria Elimination Centre DHIS2.

## Difference between the total number of CHWs and the number of CHWs providing malaria CCM



● CHWs providing malaria CCM  
○ Total CHWs

\* Thailand has approximately 1 million total CHWs.

(\$) Countries where CHWs (or a subset of CHWs) are paid government employees

In most countries (n = 17), CHWs are not government employees and not paid a salary by their respective MOH. In these countries, CHWs are considered volunteers, although they may receive a small monthly stipend (e.g., US\$37 per month in Côte d'Ivoire, \$20 per month in Cambodia and Mozambique, \$13 per month in Sierra Leone).

The World Health Organization (WHO) recommends compensating CHWs for their work “with a financial package commensurate with the job demands, complexity, number of hours, training and roles that they undertake.”<sup>3</sup> A systematic review that informed this recommendation showed some evidence that financial incentives for CHWs may lead to improved performance and increased motivation and self-confidence. Both financial and nonfinancial incentives (for example, recognition, respect, and opportunities for career advancement) have been shown to be important motivators for CHWs and reduce turnover.<sup>3</sup>

As part of this assessment, stakeholders in four countries (Burma, Madagascar, Mali, Mozambique) recommended improving incentives for CHWs. For example, stakeholders in Madagascar recommended conducting a cost-effectiveness analysis outlining potential CHW allowances, in-kind benefits, and official certification costs to recognize CHW contributions and potentially improve retention rates and performance. In Mali, stakeholders recommended formalizing the status of CHWs to make them part of the official health system rather than volunteers, thereby guaranteeing them an official salary.

In some settings, CHWs receive other types of incentives. For example, in Zambia, CHWs are unpaid volunteers. Depending on resource availability, they may receive lunch allowances for meetings, per diems during trainings, or starter kits that include a bicycle, T-shirt, hat, and medication boxes.

Where CHWs are paid, digital financial services can be used to facilitate efficient mobile payments. Using digital tools to pay health workers has been shown to increase transparency, accountability, efficiency, and cost savings for health systems and satisfaction for health workers.<sup>4</sup>

**Skills and development vary by CHW cadre, and the use of digital tools and data is limited among CHWs. Stakeholders in most PMI partner countries (n = 21) have identified the need for continuous skill development of CHWs and strengthened supervisory capacity to support CHWs.**

Some countries have standardized education and training requirements for CHWs, such as Liberia (see “Country Spotlight” box), whereas other countries do not have established standards. Within a country, there may be various cadres of CHWs with different education requirements, skills, and training. Digital platforms can be used to facilitate more standardized and continuous skill building for CHWs. Additionally, clinical decision support or job aids can be embedded in digital tools to support CHWs in providing high-quality care.

The use of digital tools is limited among CHWs in many PMI partner countries. Moreover, data collected by CHWs are primarily used for reporting to higher levels of the health system and are not regularly used for decision-making at the community level. One promising practice observed in some countries (e.g., Liberia, Senegal, Sierra Leone) is to engage community committees to support the use of community-level data.

As part of this assessment, stakeholders in most countries (n = 21) recommended some aspect of skill development for CHWs, with many recommendations focused on strengthening digital literacy and improving the use of digital tools and data. Recommendations included conducting an in-depth assessment of CHW needs and abilities (e.g., Senegal), developing job aids (e.g., Guinea), conducting trainings (e.g., Côte d’Ivoire), providing targeted quality assurance (e.g., Cambodia), or integrating data-driven program reviews (e.g., Uganda). Nigeria, Senegal, and Zanzibar recommended developing a standardized digital health training module for CHWs.

Many countries (n = 11) also recommended strengthening the capacity of supervisory staff to provide data-driven feedback, mentorship, and/or technical support to CHWs. Recommendations included developing tools, guidance, checklists, or standard operating procedures (SOPs) for CHW supervisors. Country stakeholders highlighted the opportunity to leverage digital tools, data quality standards, or data visualizations to strengthen supervision practices. For example, stakeholders in Burkina Faso recommended supporting the MOH in developing and refining supervision SOPs that include data visualization and data quality checklists to strengthen the quality of services and reporting.



## COUNTRY SPOTLIGHT

### **Liberia: A strong CHW program that will benefit from further digitalization**

Liberia has a national, professional CHW program that targets hard-to-reach communities. CHWs complete a six-month MOH preservice training, have formalized reporting lines to clinic-based supervisors, and capture standardized data that inform data-driven decisions on community health programming. CHWs are paid \$70 per month.<sup>5</sup> The government has a standardized CHW payment package that is currently funded by donors, but the government plans to gradually roll CHW salaries into the payroll. Liberia’s CHW program has been cited as an exemplar in global health. Furthermore, the country’s strong political will, push for donor alignment toward a sustainable CHW financial model, investment in data systems, and support from partners have been highlighted as strategic enablers.<sup>6</sup>

This established CHW program provides a strong foundation that can benefit from further digitalization. All 4,000 CHWs have access to an e-learning platform through Last Mile Health, and more than half of CHWs have begun using a digital data collection and aggregation tool. Stakeholders recommend supporting the MOH in developing standards for CHW inclusion in digital health pilot initiatives to encourage user-centered tool development and digital training to support CHW needs. In addition, current digital health initiatives also include plans to digitalize the national reporting systems for community health and the national CHW training curriculum.<sup>7</sup>

## Governance

**“Governance” describes the national strategies and policies that provide the framework for community health programs’ use of digital tools for malaria and their implementation.**

**Most PMI partner countries have current national malaria and community health strategies, and many have or are developing national digital health strategies.**

Nearly all countries have a current malaria strategic plan (n = 26), and most have a current community health strategic plan (n = 20). Nearly two-thirds of countries have a current national digital strategy (n = 17). The majority of these strategies include a funding strategy to support operationalization (see figure on page 20). In some countries, these national strategies are under development; for example, Nigeria’s previous National Health ICT [information and communications technology] Strategic Framework covered the years from 2015 to 2020, and reviews are underway for the National Health Act, National eHealth Policy, and the National ICT Strategic Plan for 2021 to 2025.

Where strategic plans exist, they often do not explicitly reference other health-focused strategies. For example, digital health strategies often include only a cursory mention of malaria as a health priority area. Similarly, malaria strategies do not often go into detail on digital health approaches. This may be expected, as operational policy documents may be where one expects to see additional details on implementation alignment between community health, digital health, and malaria. In some cases, there are common themes that link the strategies; for example, in Senegal, the government has prioritized strengthening community-based data, and references to community-based data show up across key policy documents, including the digital health, community health, and malaria strategic plans.

Six countries (Angola, Burma, Cambodia, Côte d’Ivoire, Guinea, Mozambique) that do not currently have national digital health strategies have recommended developing or supporting ongoing efforts to develop a national strategy. For example, stakeholders in Angola recommended creating a national digital health policy that would include plans for enterprise architecture, data sharing, and security. It is envisioned that the national Digital Health Committee will work closely with the national iCCM Technical Working Group to ensure alignment between digital health, malaria, and community health strategies.

Governance agendas that are led by local governments have a marked impact on not only the overall health management information system (HMIS) design but also its application (DRC, Tanzania). Advocating for local government buy-in to a holistic system design and strengthening local government’s capacity to manage their HMIS with a clear enterprise architecture and a development roadmap are key foundational efforts across all 27 PMI countries.

## COUNTRY SPOTLIGHT



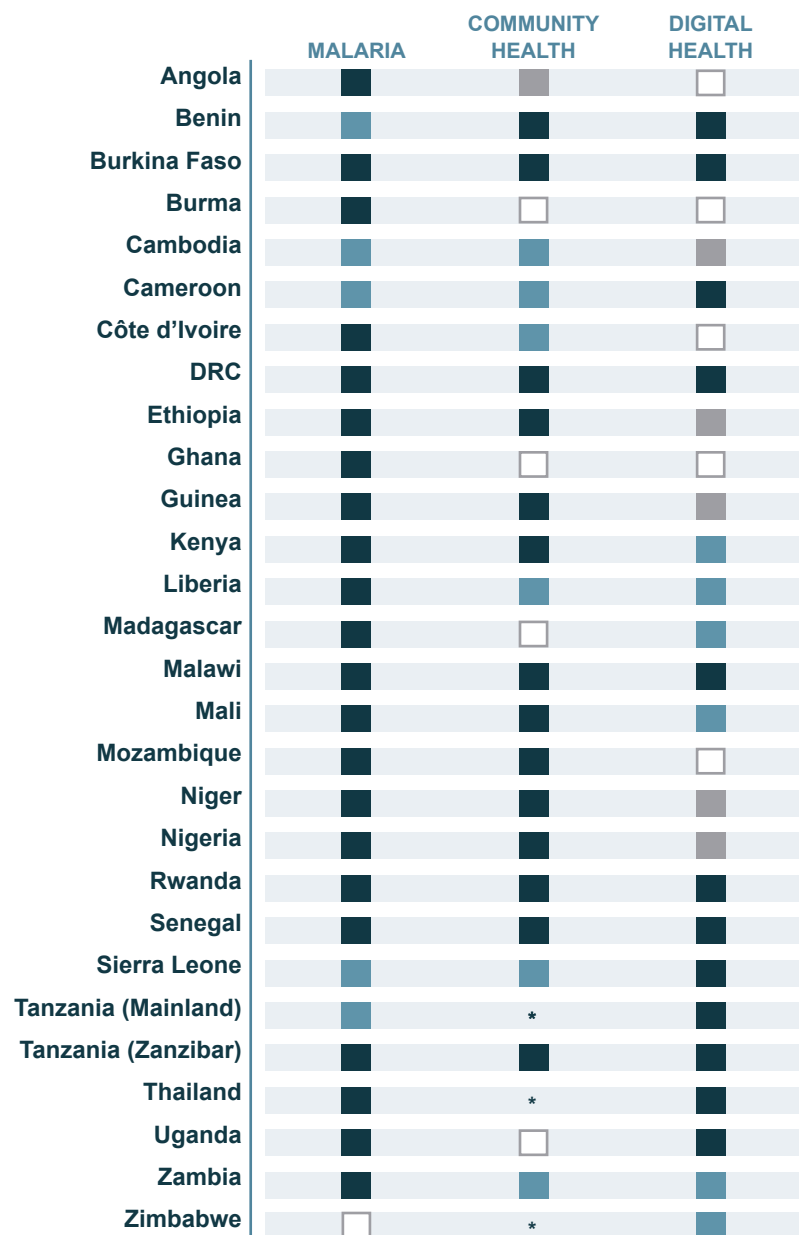
### DRC: Leadership and political will are driving digital transformation

Historically, there has been high government interest and buy-in for digital health in the DRC. The DRC has had a digital health plan in place since 2014. In March 2019, the Agence Nationale d’Ingénierie Clinique, de l’Information et Informatique de la Santé (National Agency for Clinical Engineering, Information and Health Informatics), was launched as the country’s first digital health agency, with the aim of strengthening the health system to provide high-quality, affordable health care.<sup>8</sup> It is the coordinating body for the country’s current digital health strategy.

Support for digital health continues to drive action in the DRC. Now country stakeholders are working to operationalize digital community health; their recommended actions include:

- Developing a budget to support the national digital health strategy’s investment roadmap on malaria surveillance, which will expand digital health at the community level.
- Refining existing national regulatory documents related to use of data and developing new policies for high-priority data use focus areas.
- Involving all stakeholders in the development of a digital health plan at the community level.
- Supporting the ongoing development of operational documents (e.g., work plans, SOPs, training materials) for community-based malaria surveillance, focusing on the contribution of digital tools.

## Countries with current national strategies for malaria, community health, and digital health



■ Current strategy (includes funding strategy)    ■ Under development  
 ■ Current strategy (without funding strategy)    □ No current strategy

\* Information unavailable.

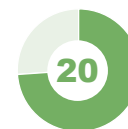
## Digital health strategies, where they exist, have not been fully implemented.

Despite having current strategic plans, including many that have funding strategies, there has been varied implementation of the digital health strategic plans. Many countries do not have policies or processes in place to operationalize their digital health strategies, such as guidelines for standards and interoperability, laws on data security or privacy, or health worker SOPs on data use.

Challenges to implementing the digital health strategies include siloed systems, lack of enterprise architecture, lack of clearly articulated policies or implementation plans, and limited funding. A common enabler of implementation is that many countries have established coordinating/governing bodies for digital health that have a scope of work or terms of reference and meet regularly. For example, in the DRC the national coordinating body for digital health is driving digital transformation (see “Country Spotlight” box).

As part of this assessment, the most common recommended actions to strengthen the implementation of national digital health strategies were related to:

- **Developing or refining digital health strategies, policies, and SOPs** (n = 20 countries), including policies and processes that focus on digital health for iCCM.
- **Strengthening coordination, leadership, and management** (n = 11 countries), including a focus on digital health coordination bodies or technical working groups to plan and oversee digital health efforts and coordinate stakeholders.
- **Increasing sustainable financing** (n = 10 countries), including resource mobilization, allocation of domestic funding, and development of long-term sustainable financing plans for digital health.



26

countries have a current national malaria strategy

20

countries have a current national community health strategy

17

countries have a current national digital health strategy



**“Systems” describes the processes and digital tools that enable community health platforms to effectively use digital technology and data to strengthen malaria and other health programs.**

**CHW data are captured in a mix of paper-based and digital tools.**

Some countries, like the DRC, are still capturing nearly all community data through paper-based tools filled out by CHWs. On the other end of the spectrum, in Cambodia, all CHWs capture malaria case data electronically using mobile devices but maintain backup paper-based reports (see “Country Spotlight” box). Most countries fall somewhere in between, having historically relied on paper-based forms and now piloting or scaling various digital health tools for community data capture.

In the traditional paper-based systems, CHWs generally submit reports to a health facility, where community data may be integrated into facility totals. This process of manual aggregation and reporting takes time and makes data about care provided at the facility indistinguishable from care provided at the community level. These aggregate reports are then submitted to higher levels of the health systems and captured in the national HMIS. All PMI partner countries, apart from Cambodia and Thailand, are using DHIS2 as their HMIS.

**Across PMI partner countries, dozens of digital tools are used by CHWs, although few are scaled nationwide. In most countries (n = 21), CHWs are currently using at least one digital tool to provide malaria CCM.**

Across countries, 32 digital tools are used by CHWs for malaria, and an additional 21 digital tools are used for other health areas.<sup>e</sup> Common tools include CommCare (nine countries), Open Data Kit (five countries), DHIS2 Tracker (five countries), and the DHIS2 Android Capture app (four countries).

Digital health tools are being used to support community-level services in several ways. Across 23 countries where digital tool functionalities were assessed,<sup>f</sup> the most common ways CHWs are currently using digital tools for malaria-related services are for providing malaria CCM, tracking malaria screening with referral, and tracking malaria proactive and reactive case detection (see “use cases” in the figure on page 22). The figure on page 22 also summarizes the number of countries where CHWs are using digital tools for malaria or other health areas to support case management and/or management and supervision functionalities. In some countries, CHWs are using tools that have these functionalities, but the functionalities are not currently in use. Additional details on the country-specific tools and functionalities are available in the country profiles on the [Digital Square website](#).

<sup>e</sup> This assessment identified digital tools that had achieved some level of scale at the time of data collection. These are approximate numbers and should not be considered absolute or comprehensive.

<sup>f</sup> This excludes Ethiopia, Niger, Zambia, and Zimbabwe, where analysis of digital tools was not yet complete at the time of writing.



### **Cambodia: A sophisticated surveillance system and CHW mobile app**

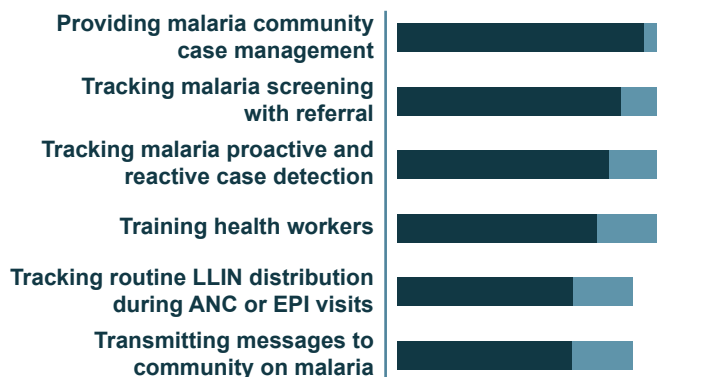
Cambodia’s centralized malaria information system (MIS) is a comprehensive digital malaria surveillance system that includes case management, vector control, and stock management components. The MIS captures data from community to national levels and includes geospatial data, a broad range of indicators, and data dashboards for decision-making.

CHWs use a mobile app to submit real-time data to the MIS, thereby bringing surveillance as close to at-risk communities as possible. In addition to the case management, vector control, and stock management components, the app includes treatment-adherence messaging for confirmed *Plasmodium vivax* cases and generates automated notifications of confirmed cases to provincial and national levels. The main challenges to the community-level use of the MIS include varying CHW capacity, damaged or lost smartphones, and data-syncing delays due to poor connectivity.

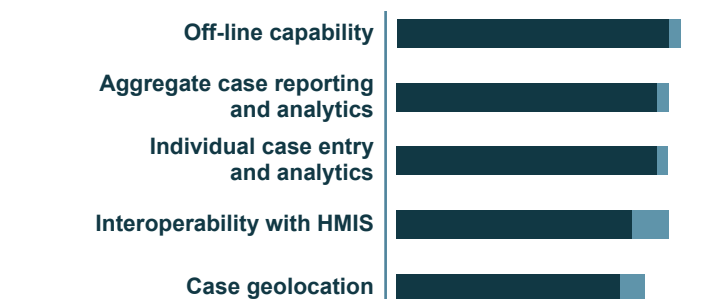
Currently, aggregated MIS data are shared with the broader HMIS monthly, but there is a long-term goal to integrate the MIS into the HMIS for sustainability. According to one community-based stakeholder, “Using a single, streamlined reporting form at the community level would be ideal.” Other MOH priorities include strengthening real-time reporting of case management data at community and facility levels, promoting data use at subnational levels, and focusing additional digital health innovations in hot spot geographic areas.

## Countries currently using digital tools for malaria use cases and associated functionalities

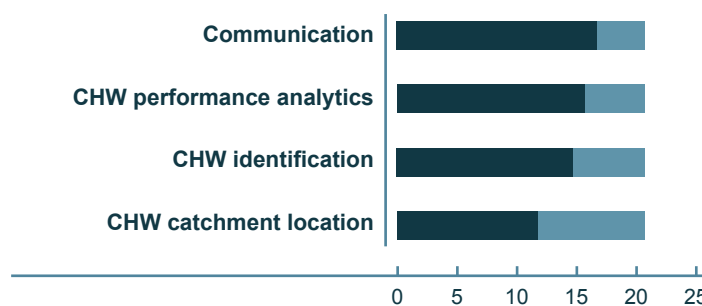
### USE CASES



### CASE MANAGEMENT FUNCTIONALITIES



### MANAGEMENT AND SUPERVISION FUNCTIONALITIES



■ # of countries with 1 or more tools currently in use for this use case / functionality  
 ■ # of countries using tools where use case/functionality is possible, but not currently in use

## Stakeholders in many countries have identified the need to support integration and interoperability of digital tools and existing systems.

Digital tools can support CHWs in improving the effectiveness and efficiency of the care they provide, but introducing multiple digital tools can also lead to fragmentation if the tools are not aligned to common standards or connected to HMIS reporting systems. Interoperability is the ability of different systems to meaningfully exchange information with one another. This is important to reduce duplication and fragmentation, increase cost efficiencies, and support continuity of care by tracking patients across various service delivery points.<sup>9</sup>

As part of this assessment, stakeholders in more than half of the countries (n = 15) prioritized recommendations that focused on integration and interoperability of digital tools across disease verticals and from national to community levels. These recommendations included building an interoperability layer between digital tools and the HMIS (e.g., Angola, Ghana, Mozambique, Rwanda, Senegal), testing or verifying interoperability through benchmarking tests (e.g., Guinea), and identifying appropriate, interoperable CHW data collection tools to scale (e.g., Cameroon, Madagascar).

## In many countries, the subnational availability of consistent electricity and mobile connectivity is limited, which is an important consideration for the use of digital tools.

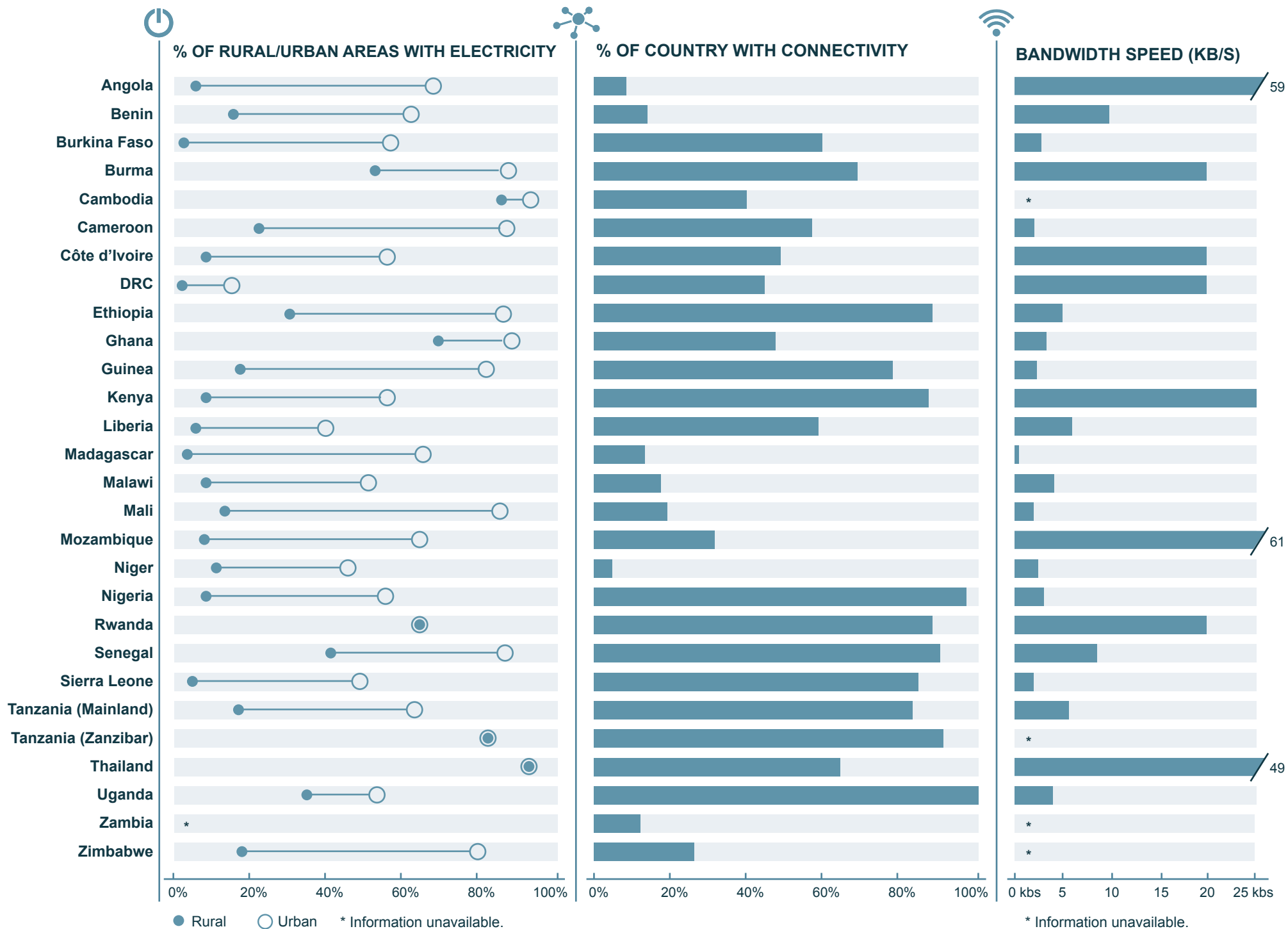
Consistent electricity is important for charging mobile devices or tablets. Cambodia and Thailand have the most widespread electricity, with over 90 percent of urban and rural areas having consistent electricity (see figure on page 23). In all other countries, the percentage of rural areas with electricity falls behind the percentage of urban areas. In most countries (n = 18), fewer than 25 percent of rural areas have electricity. However, there are solutions, such as solar chargers, that can enable the use of digital tools in areas with limited electricity.

Mobile connectivity is important for accessing or syncing data. In many countries, portions of the population are not within range of an advanced mobile-cellular signal (see figure on page 23). Many digital health tools have off-line functionality, where data are saved locally and synced when in connectivity range, to address this. As shown in the figure to the left, 23 countries are already using off-line capability of digital tools.

Bandwidth speed measures the amount of data transmitted in a second. For example, lower bandwidth speeds can support sending a text message, but higher speeds are required to stream video. Digital tools should be designed to take into account low bandwidth settings.

Through this assessment, four countries (Burma, Ghana, Liberia, and Mozambique) recommended strengthening the enabling infrastructure for digital health. Stakeholders in Ghana and Liberia recommended identifying opportunities for public-private partnerships with local telecommunications companies to improve electricity and mobile connectivity to support the use of digital tools.





# Global recommendations

In each of the 27 PMI partner countries, stakeholders jointly identified recommended actions for people, governance, and systems based on the assessment findings. The country-specific recommendations are available in each country profile on [Digital Square's website](#). This report focuses on cross-country, or global, recommendations in response to gaps, lessons learned, opportunities, and promising innovations identified across countries. The recommendations outline high-priority actions for PMI, its partners, local actors, and other donors to focus on in supporting country governments to strengthen their community digital health systems.



## PEOPLE

**Investing in the community health workforce is necessary to successfully operationalize digital health. Enough CHWs should be available and deployed to support high-priority at-risk communities, they should have adequate skills and literacy to use digital tools for iCCM, and they should be integrated as a valued aspect of the national health system. Digital tools can help support the training, quality of service, and reach of the community health workforce and can play a role in supporting efficient investments in workforce development. With a strong workforce in place, data generated by CHWs can be used by CHWs and across all levels of the health system to reduce the burden of febrile illnesses.**

### Recommendations to achieve this include:

**Center the end-user needs of CHWs and the communities they serve to inform the design and use of digital tools for community-based interventions.. Participatory, in-depth assessments can improve understanding of user needs, availability, capacity and skills, geographic location, and administrative reporting lines.**

Digital tools are most effective when they meet end-user needs and are designed for the existing ecosystem. Assessments that engage CHWs and the communities they serve can be a starting place to understanding the realities, workloads, and challenges of CHWs and the community needs. These assessments can inform what role, if any, digital tools can play in supporting CHW service delivery, workforce management, or education and training. Where it is determined digital tools can add value, end users should be engaged in designing the requirements for the tools.

Assessments could also be designed to capture information on the number of CHWs, their capacity and skills, geographic location, and administrative reporting lines. This information can inform workforce planning to align CHWs with community needs (e.g., where to prioritize CHW recruitment or training and how to best mobilize CHWs to support iCCM, including through targeted subnational stratification of CHWs). In-depth assessments could be conducted in prioritized countries and/or subnational areas where disease burden is highest, community demand is highest, CHW gaps are greatest, and the national program is invested in expanding iCCM. Lessons learned from initial in-depth assessments in high-priority countries should be captured and applied to future assessments elsewhere.

**Enhance motivation and performance of CHWs through strengthening (1) supportive systems, (2) professional development and training opportunities, and/or (3) community accountability.**

Strengthening supportive systems may include clarifying supervisory roles, implementing regular supportive supervision, creating CHW peer-learning groups, and reinforcing feedback loops between CHWs and supervisors. Digital tools can be used to manage CHWs and their reporting lines, communicate between CHWs and supervisors, enable 360-degree feedback processes up and down the health system chain (including direct feedback from communities), and analyze CHW performance. Strengthening professional development for CHWs and their supervisors may include customized trainings through existing platforms like the WHO Regional Office for Africa training series and TechChange Digital Health 101 course, increased access to certification programs; and other skills expansion processes. Digital tools can be a platform for CHW trainings, peer learning and engagement, deliberate skill building, and on-demand learning.

## (PEOPLE RECOMMENDATIONS CONTINUED)

Finally, strengthening community accountability can stem from improved CHW access to data about their community or from engagement with local community councils or leaders. Importantly, drivers of motivation and performance may vary across cultures; therefore, they should be adapted to the local context. Successful approaches that enhance CHW performance should be amplified and shared.

### **Support country governments to pay CHWs for their time and services, leveraging digital tools for efficient mobile payments if necessary, and assess any resulting changes in the quality of care.**

In line with the WHO recommendation, country governments should provide financial incentives that are commensurate with the CHW role, responsibilities, and training.<sup>3</sup> CHWs should be recognized and integrated as formal health system employees and paid a salary accordingly. In some countries, donors or other partners fund CHW salaries, but governments should take up this responsibility to ensure sustainable, uninterrupted funding. Digital financial services can be used for payments to health workers, which has been shown to increase transparency, accountability, efficiency, and cost savings for health systems and satisfaction for health workers.<sup>4</sup> Finally, there is some evidence that financial incentives can lead to improved quality of care and CHW retention. This link should be researched further and the findings published to inform scale-up of CHW payments to new contexts.



## GOVERNANCE

National malaria, community health, and digital health strategies should exist and be costed, funded, implemented, and updated regularly. National digital health and community health strategies should be aligned and support each other, and government authorities should lead and own the coordinated implementation of these strategies.

### Recommendations to achieve this include:

**Support country governments to lead the implementation of digital health and community health strategies, and use the implementation process to coordinate and identify synergies across different strategies. Governments should engage CHWs and other relevant stakeholders—for example, through multidisciplinary technical working groups or coordination bodies.**

As countries focus on implementing their national digital health strategies, strong leadership, management, and coordination are important drivers of digital transformation. Government authorities should own and lead these processes, and implementing partners, donors, and other stakeholders should align to government priorities as outlined in the national strategies. Digital tools and data cut across health verticals ; thus, they require coordination across varied stakeholders to support common data standards and interoperable systems. Creating multidisciplinary technical working groups with clear mandates, work plans, and financial resources can support this aim. Technical working groups should engage and include stakeholders from the community health program, including CHWs and community members interacting with CHWs, for input on user-friendly digital tools for CHWs and CHW-community interactions.

**Collaborate with global and/or regional institutions to review and contextualize global standards and support the implementation of standards in PMI partner countries.**

Stakeholders in most PMI partner countries recommended supporting the integration and interoperability of digital tools—which rely on existing globally developed data, technology, security, and privacy standards, as well as mechanisms for data exchange—to enable data sharing across platforms. This includes, for example, capturing common data elements with standardized naming conventions for malaria surveillance. Using global standards can save money, lay important groundwork for multisource data analytics, support efficient cross-border data sharing in

## (GOVERNANCE RECOMMENDATIONS CONTINUED)

regional disease elimination and/or epidemic response efforts, leverage and improve existing work, avoid duplication, and increase collaboration in the digital health community. Global and regional institutions can partner with country governments to adapt these global standards to fit country needs. For example, the Africa Centres for Disease Control and Prevention leads in the development of global goods aimed at strengthening HIS capacity, governance, and interoperability. The agency works with countries to adapt, scale, and sustain these centrally developed technologies, tools, and guidelines.

### **Document and disseminate learnings and promising practices from country experiences in operationalizing digital health strategies.**

Many countries have newly developed digital health strategies and plans that they are now beginning to implement. As countries develop actionable processes, policies, and frameworks, there is an opportunity to share these as resources and examples for other countries. Countries should also share promising practices in operational alignment between digital health, malaria, and community health. Dissemination should leverage existing cross-country networks (e.g., the Digital Solutions for Malaria Elimination Community of Practice, the Digital Regional East African Community Health Initiative, or the Asia eHealth Information Network), regional governing bodies (e.g., the African Union, WHO Regional Office for Africa), and technical resource bodies (e.g., the Africa Centres for Disease Control and Prevention). In the context of COVID-19, international dissemination of learnings and practices increasingly rely on digital platforms, and the value of virtual peer-learning networks has never been greater to support the accelerated adoption and scale-up of interventions that work.



## SYSTEMS

Countries should have a clear vision for their national digital HIS and ecosystem that includes data flows between CHW source data and national data warehouses. Digital health tools should be sustainable, adaptable, aligned to national interoperability standards, used where needed, designed with the end user, and have functionalities to support CHW febrile illness management and data-driven decisions.

### **Recommendations to achieve this include:**

#### **Explore new types of partnerships, such as with local organizations or the private sector, to strengthen the digital health ecosystem and improve the sustainability of digital health systems.**

Partnering with local organizations that are closer to the target populations can ensure that digital tools, data management systems, dashboards, and data repositories are maintained and continuously upgraded to best represent the changing local context while aligning to the national HIS vision and standards. In some contexts, there are opportunities for strategic partnerships with private-sector institutions that can support sustainability and scale by providing technical support, equipment, or funding. One area where public-private partnerships have been successful is in strengthening the electrical, digital, and mobile infrastructure; for example, country governments can partner with telecommunications companies to address gaps in electrical and connectivity infrastructure, particularly in rural areas, to enable CHWs to use digital tools. Telecommunications companies can also provide data that can unlock new insights about population health.<sup>10</sup> Research is needed to support the private sector in identifying the opportunities that public-private partnerships present—in particular, the long-term revenue streams from such partnerships or the ways in which they contribute to the private sector's goals in governance, ethics, and sustainability.

## (SYSTEMS RECOMMENDATIONS CONTINUED)

### **Define and implement country-specific enterprise architecture that includes a long-term vision for HISs, including their ability to support integration of the full package of health services that CHWs deliver.**

Enterprise architecture provides a holistic vision or framework for how various systems should capture, store, manage, or share information across the health sector. Governments that have this architecture can use it to clearly articulate the policies, norms, and standards that digital systems need to comply. Governments can also use it to work with partners to identify an efficient portfolio of digital interventions to meet their health needs. In low-resource settings, this portfolio likely includes many global goods, in alignment with the U.S. Agency for International Development's *A Vision for Action in Digital Health*.<sup>11</sup> The enterprise architecture should include a clear vision for how community health data should be captured, shared, and used—not only to meet the technical realities of the near term but also potential long-term needs. Data needs will evolve over time as countries move toward malaria elimination; therefore, countries may need to introduce new functionalities to their HIS, such as geospatial data for individual cases, which should be anticipated and captured in the enterprise architecture.

### **Advance the interoperability of tools and systems—across disease verticals and levels of the health system—to streamline data collection and management and improve opportunities for data use.**

Connected systems reduce overlap and redundancies in data capture and allow decision-makers to bring together information from across disease programs or health areas for better decision-making. This includes making sure digital tools and data are interoperable from the community to the national level and across disease verticals. Since most PMI partner countries are using the DHIS2 as their national HMIS, digital tools should prioritize interoperability with DHIS2. The enterprise architecture should also include a logistics management information system that is interoperable with the country HMIS to ensure sufficient commodities and equipment from the national to the community level.

### **Invest in global goods that are frequently used for iCCM and CHW management, and support countries to scale these digital tools.**

Investing in digital health tools that can be used across different countries and contexts (often referred to as “global goods” or “digital public goods”) can reduce fragmentation and duplication and accelerate scale and health impact. Investments in core software can strengthen digital health tools for country uptake—for example, by adding functionalities that are not currently available but are prioritized by multiple countries. As mentioned above, the end users (e.g., CHWs, their supervisors, and communities) should be engaged in a user-centered design process. Investors and partners should also support countries to scale existing tools, for example, by investing in hardware and software or training CHWs on the use of digital tools.

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