

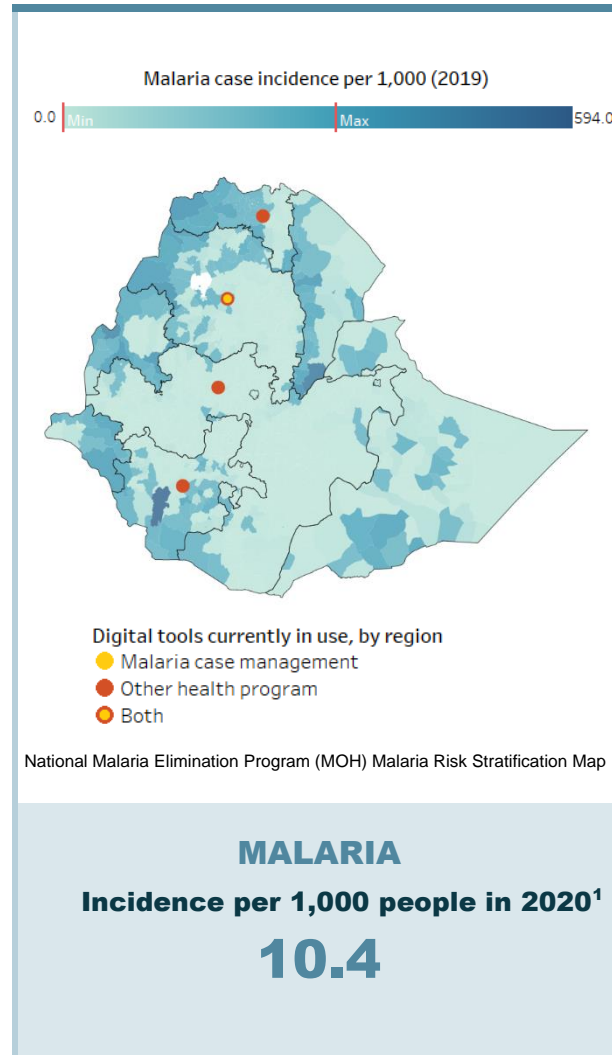
# ETHIOPIA

## Executive Summary

Ethiopia has seen a 67 and 47 percent reduction in malaria mortality and cases, respectively, over the past five years due to sustained interventions.<sup>1</sup> Nearly half the population live in malaria-free areas, and an additional third live in low or very low malaria-endemic areas. The National Malaria Strategic Plan (NMSP) 2021–2025 is aimed at nationwide malaria elimination by 2030, with a focus on surveillance and response systems.<sup>1</sup>

At the community level, malaria services are delivered through a nationally scaled Health Extension Program (HEP), which employs full-time salaried health extension workers (HEWs) to provide services at health posts (HPs) and outreach in the community. A national electronic Community Health Information System (eCHIS) is being scaled to streamline data collection and flow. However, implementation challenges remain: gaps in HEW digital readiness, disparate HEW training activities, and gaps in technical support for HEWs.

The government of Ethiopia has a strong track record of implementing digitalized health information systems to improve access and quality of health data.<sup>2</sup> However, more efforts are needed to encourage uptake of and support for digital tools, especially at subnational levels. These efforts may include coordinated training efforts, incentives for data use, and enforced policies and guidelines at the community level.



**PEOPLE**  
**Health Extension Workers (HEWs)**



**~40,000** HEWs  
covering 17,500 health posts<sup>3</sup>  
4 per 10,000 people (agrarian & urban)  
6 per 10,000 people (pastoral)<sup>4</sup>

**GOVERNANCE**  
**National Digital Health Strategy**



**Yes**

**SYSTEMS**  
**Digital Health Index<sup>5</sup>**



**SCORE: 3**



# Recommended Actions

Please see “Extended recommendations” (Appendix F) for more details.

## PEOPLE



HEWs and other decision-makers

### **Coordinate the HEP eCHIS training efforts among partners to create a streamlined process across activities**

Support streamlining multiple basic and refresher training curricula into a single HEW training package via digital tools. Current efforts are underway with Ethiopia Digital Health Activity (DHA) and community health academy to develop and mainstream eCHIS online training. These efforts require a coordinated partner approach and implementation plan to integrate eCHIS in the HEP pre-service, in-service, and skill-building training programs using interactive training techniques (e.g., Moodle, OppiaMobile, and LEAP) for learning and experience sharing, as well as job shadowing at health facilities.

### **Assess existing barriers to HEW data management and develop practices to incentivize data use**

Assess and leverage existing data review processes to scale and strengthen existing HEP data management structures. Promote best practices for evidence-based decision-making at all levels of the health system via incentives.

### **Strengthen information technology (IT) and data use support**

Support DHA to identify opportunities to leverage existing staff and local IT providers, such as small business enterprises’ help desks and toll-free numbers, to provide day-to-day digital and data use support and increase coverage of these services at the community level.

## GOVERNANCE



Strategies and policies

### **Support the HEP to align with the digital health strategy and *National Digital Health Blueprint***

Ensure HEP community digital health efforts are aligned with the digital health strategy and government efforts to support resources dedicated to staffing, device management, maintenance, infrastructure, and monitoring and evaluation (M&E) of HEP digital health tools.

### **Strengthen procurement procedure for digital hardware/software and commodities with special emphasis in supporting the private sector**

Strengthen the digital health strategy and policy implementation with a detailed procurement process plan to ensure adequate funding for implementation and sustainability. This plan should identify innovative financing methods, such as a pooled procurement model for the public and private sectors.

### **Strengthen national eCHIS digital health coordination body / technical working group (TWG)**

Strengthen functionality of existing eCHIS coordinating structures by establishing routine meeting structures and processes for reviewing progress on activities and addressing implementation bottlenecks. Consider including regional stakeholders and partner representatives (such as PATH) in the eCHIS coordinating body.

## SYSTEMS



Processes and digital tools

### **Build on the implementation of the Master Facility Register (MFR) to develop health post catchment-based malaria risk map to inform the malaria elimination interventions**

Supporting a granular malaria risk map can ensure an advanced surveillance system through continuous improvement of data indicators. Support data quality through routine data quality audits.

### **Support the implementation of the malaria case and foci investigation module of eCHIS**

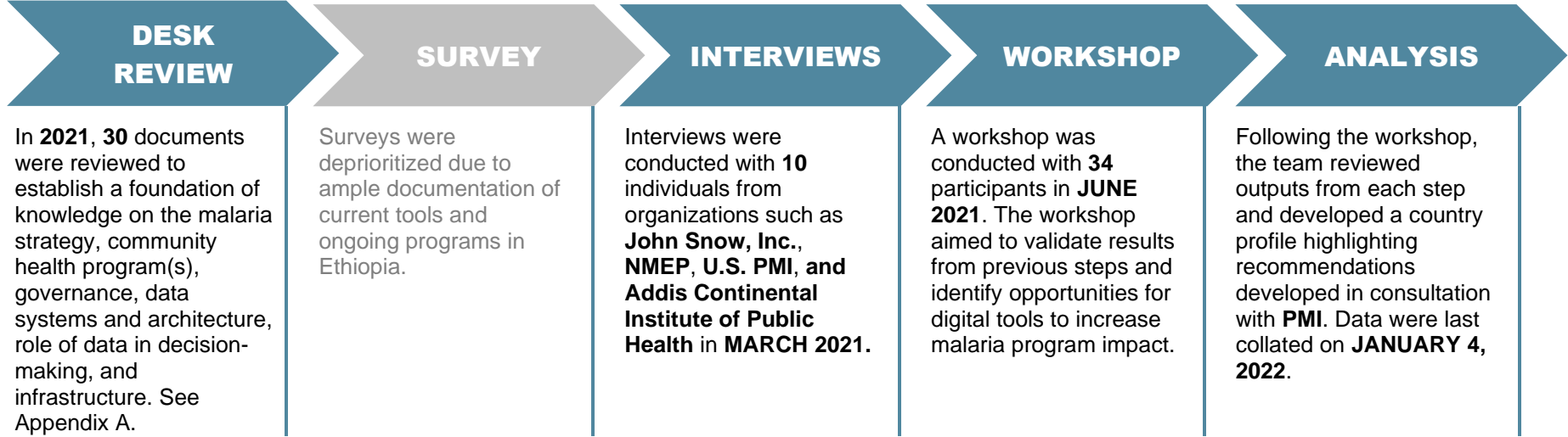
Support the National Malaria Elimination Program (NMEP) implementation of the eCHIS malaria surveillance system and response, which could include M&E of community-level case and foci investigation.

### **Support the development of an analytic and visualization dashboard for NMEP**

Support the development of a single malaria dashboard by pooling data from eCHIS, Public Health Emergency Management, District Health Information Software 2, ground station data, and other systems to visualize malaria data and strengthen feedback loops down to the community level.

# Methodology


PATH conducted a desk review, key informant interviews, and a consultative workshop to develop the content and recommendations in this document. The survey that was initially planned was not completed due to the ample amount of available information and documentation of current tools and ongoing programs in Ethiopia. The interviews and workshops replaced the survey for focused discussions to validate information and prioritize recommendations. Individuals and organizations were selected for participation based on their background knowledge, experience, and professional position in the areas of malaria, community health, and/or digital health.



Information collected through the methods described above was categorized according to key components within three domains: people, governance, and systems. These domains and their underlying components were informed by an [existing maturity model](#) and adapted to incorporate malaria-specific content. The components include personnel, training, and technical support (“People”); policies, strategies, and governance structures and their implementation (“Governance”); and data flow, digital tool structures, functionalities, and use (“Systems”). Together, these components describe the *desired state* for HEW use of digital tools for community case management (CCM) of malaria, a state in which community health programs can leverage digital tools to generate and use data that improve malaria programming with the ultimate aim of decreasing the local malaria burden.

**PEOPLE** 

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

**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.

**SYSTEMS** 

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.

## People



Established in 2003, Health Extension Program employs full-time salaried HEWs who provide basic health services at HPs and in the community. HEWs are selected by the *kebele* (community) administration and are required to have a high school diploma and complete one year of technical training at an institute or college. HEWs are typically supervised by staff at a health facility or at the *woreda* (district) health office. HEP is government financed through block grants, with some technical and financial support from bilateral, multilateral, and nongovernmental organization partners.<sup>6</sup>

The revised Essential Health Service Packages includes 1,019 evidence-based interventions.<sup>3</sup> Within this package, HEWs provide a range of health services, including integrated community case management (iCCM), reproductive health, and prevention and treatment of communicable and noncommunicable diseases. CCM of malaria is universal, and HEWs are trained to administer rapid diagnostic tests, treat uncomplicated malaria, refer severe malaria patients, and administer pre-referral rectal artesunate. In addition, HEWs coordinate insecticide-treated net (ITN) distribution, supervise indoor residual spraying activities, and assist in the identification and control of larval habitats.<sup>1,7</sup>

In 2016, the Federal Ministry of Health (FMOH) launched the second-generation HEP to scale the program nationally to 4,500 HPs and expand the package of services to focus on noncommunicable diseases. The HEP varies based on the area of implementation (urban, agrarian, or pastoral). For example, HEWs do not provide iCCM in pastoral areas. The rural agrarian HEP includes upgrading HEWs to level 4 community health nurses and shifting basic services to the community level with the Women Development Army (WDA), also referred to as the Health Development Army.<sup>8,9</sup> The WDA is a volunteer network to promote healthy behaviors and primary health care use within households.<sup>10</sup> To revitalize the WDA, competency-based training was deployed to over 130,000 WDAs in 2019. HEWs provide supervision of and support to WDAs.<sup>3</sup> The FMOH has committed to working with regional governments on mobilizing resources, ensuring human resource capacity, and introducing the new HEP package.

### Community health worker digital readiness

Ethiopia is transitioning its national Community Health Information System (CHIS) to digital (eCHIS), replacing the paper-based reporting process for HEWs, including the Family Form data collection tool (Family Folder); it is intended to be deployed on tablets for HEWs in all HPs.<sup>11</sup> The development of this system is ongoing and being deployed on a rolling basis with support from USAID's Digital Health Activity (DHA) project and implementing partners, including John Snow, Inc., and Dimagi. In addition, Living Goods is working with the FMOH to assess and propose improvements to the HEP performance management processes and systems. HEW digital readiness is challenged by shortages of tablets, poor Internet and electricity connectivity/access, and outdated training in tools and systems. Digital literacy is a barrier to HEW digital health capacity, with older HEWs more resistant to new tools due to concerns about losing data.<sup>10</sup> Currently, no digital health curriculum exists, but one has been proposed by the FMOH and is under review as part of training requirements for HEWs. Training on the new features of eCHIS will be provided to HEWs at district or zonal levels.<sup>12,13</sup> Trained digital health and informatics professionals are deployed, but technical support is centralized and managed by the FMOH, creating gaps in support for digital applications.<sup>14</sup> In-country partners are seen to have more capacity to support HEWs with hardware/software implementation and dedicated technical support.<sup>10,12</sup>

<b>40,000</b> Health extension workers in country	<b>Compensation policy:</b> <b>PAID</b> Paid by government
<b>40,000</b> Providing malaria community case management	<b>Compensation policy:</b> <b>PAID</b> Paid by government

## Data-driven decisions at each level of health system

A Primary Health Care Unit (PHCU) includes one health center (HC) serving from 25,000 people (in rural settings) to 40,000 people (in urban settings) and five community HPs, each serving from 3,000 people (in pastoral settings) to 5,000 people (in agrarian settings). Health data flow from the HEWs at HPs through health facilities, *woreda* health offices, the zonal health department, and then the FMOH.<sup>5</sup> Data are accessed from two sources within the District Health Information Software 2 (DHIS2) platform: the Health Management Information System (HMIS), which is monthly data managed by the Plan Policy and Monitoring & Evaluation Directorate (PPMED), and weekly epidemiological data, managed by the Public Health Emergency Management (PHEM) at the Ethiopian Public Health Institute.<sup>6</sup> Providing feedback to lower levels on the data submitted is expected throughout the health system based on protocols for supervision and data review.<sup>14</sup> However, a recent analysis indicated that this was done progressively less often at lower levels: in the study sample, 76 percent of *woreda* health offices, 53 percent of health facilities, and 36 percent of HPs reported receiving any feedback in the previous three months.<sup>15</sup> An Open Data Kit–based application has been used for integrated supportive supervision, and the monitoring dashboard is developed on Google Data Studio. However, the tool is not cascaded to the lower levels of the health system. Additionally, most data platforms ensure data availability for decision support and M&E for authorized users, but the level of access afforded to each user depends on the level of the user.<sup>1</sup> For example, most users can capture and analyze data; however, providing maintenance, adding metadata, and adding new users can only be done by users at the national level.<sup>7</sup> In addition, data can be added or removed at any time by users with access, creating discrepancies and issues with data entry quality.

<b>NATIONAL LEVEL</b>	The HMIS is the primary source of data for monitoring health services and malaria activities continuously. HMIS and PHEM data are used to conduct malaria stratification and mapping to inform priorities and interventions for Ethiopia’s Malaria Strategic Plan 2021–2025. <sup>4</sup> Once malaria eCHIS data are being synced with the central data server, malaria case investigation indicators can be analyzed and visualized at the national level, although this has yet to be fully implemented. An ITN dashboard is used by the Ethiopia Pharmaceutical Supply Agency and FMOH to monitor and track distribution of ITNs and campaign progress. The Supply Agency manages Fanos, the supply chain dashboard with Expanded Program on Immunization commodity data from all levels of the health system. Programmatic decisions around digital health systems for the country and at the community level are made in consultation with the PPMED, the M&E TWG, the Health Information Technology Directorate, the National Advisory Group, and the Information Revolution Steering Committee. <sup>7,8</sup>
<b>REGIONAL LEVEL</b>	Aggregated malaria mortality and morbidity data are reviewed down to the <i>woreda</i> level but do not go beyond to the health facility or community level. <sup>6</sup> In addition to national decision-makers, regional health bureaus (RHBs) are consulted on the use of digital health systems. <sup>10</sup> Officers at the regional level act as focal persons for DHA and work with national digital staff to support digital health initiatives at lower levels of the health system. <sup>16</sup>
<b>DISTRICT / SUBNATIONAL LEVEL</b>	At the <i>woreda</i> office level, data from the HMIS are used to produce reports and conduct monthly performance monitoring of PHCUs. HMIS and PHEM data are used for policy and advocacy around setting targets, mobilizing resources, ensuring epidemic preparedness, and providing accurate logistical support to lower levels. <sup>5</sup>
<b>PHCU LEVEL</b>	HCs use DHIS2 for documenting disease epidemiology and services, including malaria case management and case-based surveillance (in elimination-focused areas), to report into the national data server. Support staff and providers at hospitals and HCs access community-based data from summary reports and conduct performance monitoring to improve continuity of care. PHCUs typically conduct performance monitoring team meetings on a monthly basis. Managers can use dashboards in DHIS2 and eCHIS to track trends and review HEP performance. <sup>10</sup>
<b>COMMUNITY / HEALTH POST LEVEL</b>	HEWs use CHIS data for service delivery, case-based surveillance, foci investigation, and follow-up with community members. Aside from the HPs that are piloting the submission of the monthly service delivery and commodity reports in eCHIS and other digital tools, HEWs submit their service reports and commodity requests via paper forms to the health facility. <sup>17</sup> Data collected from paper reports are used to create malaria monitoring wall charts that track the number of weekly cases to detect early epidemics. <sup>6</sup>

# Governance



	DIGITAL	COMMUNITY HEALTH	MALARIA
<b>Name</b>	<i>National Digital Health Blueprint</i>	<i>Roadmap for Optimizing the Ethiopian Health Extension Program</i>	<i>National Malaria Strategic Plan (NMSP)</i>
<b>Current strategy dates</b>	2021–2030	2020–2035	2021–2025
<b>Coordinating body</b>	Health Information Technology Directorate	Health Extension and Primary Health Care Directorate	National Malaria Elimination Program
<b>Funding strategy</b>	No	Yes	Yes

Ethiopia’s digital health priorities are outlined in the newly launched *National Digital Health Blueprint* (DHBp). The DHBp was developed in coordination with the Health Information Technology Directorate and PPMED of the FMOH, as well as various FMOH agencies, implementing partners, and Mekelle University. The aim of the DHBp is to create a foundational plan for digital health in Ethiopia and provide an overarching blueprint to govern fragmented digital health initiatives. The DHBp outlines ten high-impact digital health intervention areas, which include performance management, decision-making support and learning, data exchange across systems, point-of-care and diagnostic technologies, and digital literacy. The DHBp does not mention specific health focus areas. However, it does highlight the need for electronic HIS, including the eCHIS, to be interoperable and promote better data use through a unique digital ID for every citizen to be used across all HIS. It also addresses the need for digital literacy through the HEP and other community-based programs.<sup>18</sup> Supporting digital health as part of the HEP is a government priority. In addition, a national HIS governance framework exists that defines eHealth governance principles, structures, and partnership and coordination mechanisms. A recent HIS maturity assessment conducted in August 2021 outlined areas of strength and major gaps with the FMOH and put forth goals for the future HIS maturity state. A key component of this future state is updating, endorsing, and overseeing comprehensive HIS policies, legislation, strategic plans, and funding strategies to improve HIS governance.<sup>2</sup>

The new HEP roadmap, *Realizing Universal Health Coverage Through Primary Healthcare: A Roadmap for Optimizing the Ethiopian Health Extension Program 2020–2035*, launched as a longer-term vision for the program with a focus on stratifying HPs, redefining the health service packages, identifying the appropriate professional structure, rethinking community engagement strategies, ensuring sustained financing, and maintaining essential service delivery during public health emergencies. One of the strategic objectives of the roadmap is the digitization of the HIS and measurement and evaluation for the HEP. The roadmap explicitly calls out opportunities for digitalization of information systems, electronic data sharing, and virtual trainings to meet challenges in data use and reporting. The HEP is dependent on donor funding, with external assistance accounting for 60 percent of HEP spending, according to a 2019 analysis. Declining government health expenditures on the HEP indicate a deteriorating commitment to it. In addition, the HEP faces challenges such as lack of clear governance structures, weak mentorship, and lack of accountability for HP performance.<sup>5</sup>

The NMSP 2021–2025 lacks a focus on digital technologies but does indicate that health technology for real-time surveillance is poorly applied, suggesting an opportunity for digital technology to support diagnosis of malaria at the community level, case-based surveillance in elimination-targeted areas, and other data reporting. Community health features prominently in the NMSP, which articulates the centrality of community interventions and the critical role of the HEP in addressing malaria in Ethiopia. The strategy includes a focus on strengthening provision of malaria CCM by training HEWs in diagnosis and

quality assurance as part of ICCM. In addition, the strategy proposes deploying community surveillance officers to assist HEWs in improving routine surveillance and preparing for epidemic response.<sup>1</sup>

<p><b>GOVERNANCE</b> Policies define digital health and health data governance roles, responsibilities, and structures.</p>	<p>The FMOH is responsible for decision-making, including registration and monitoring of all digital health systems.<sup>19</sup> The FMOH released the DHBp in September 2021, which provides a coordinated approach to govern digital health initiatives. In addition, the <i>HMIS Information Use Guide</i><sup>20</sup> includes guidelines on registers (Family Folder, tally sheets, and reporting forms) used by all health facilities and on quality assurance.</p>
<p><b>DATA MANAGEMENT</b> Policies provide specifications for data access, privacy, security, and confidentiality and outline stipulations for data sharing.</p>	<p>Data security, data privacy, and data confidentiality are featured in the national health information proclamation, which is currently being drafted by the PPMED. In addition, a data access and sharing directive has been drafted but has yet to be approved by the Council of Ministers.<sup>8</sup> Data-sharing standards are governed by directorates and the TWG within the FMOH. The Information Network Security Agency is the governing body overseeing security issues.<sup>7</sup></p>
<p><b>STANDARDS AND INTEROPERABILITY</b> Policies describe an enterprise architecture, normative standards—such as health information standards—and digital identity.</p>	<p>The FMOH has drafted a national eHealth Architecture (eHA) roadmap, which includes priorities to drive greater integration and eHA maturity. The FMOH has also prepared interoperability and messaging standards to support different eHA components.<sup>21</sup></p>
<p><b>INFRASTRUCTURE</b> Policies define data hosting and storage (e.g., local or cloud), mobile device management, and telecommunications access.</p>	<p>Currently, Ethiopia lacks policies on infrastructure, coverage targets, and accountability for providers. Policies for telecom services, norms, equipment, and devices are missing or not enforced.<sup>20</sup> The Health Information Technology Directorate is the governing body overseeing decisions around infrastructure related to software, servers, and operating systems, as well as digital health tool implementations.<sup>7</sup></p>
<p><b>WORKFORCE</b> Policies describe workforce job structures and descriptions, plans for training, digital literacy expectations, and incentives for digital adoption.</p>	<p>The DHBp includes plans to strengthen the digital health workforce capacity over the next ten years through revising the current workforce structure, updating training and curricula, and enhancing digital health education and training programs.<sup>18</sup> A collaboration between the FMOH, Data Use Partnership, RHBs, and higher education institutions has produced a national human resource roadmap for HIS for 2021–2030. The roadmap includes harmonization of academic training and a revised curriculum. The collaboration has also increased the number of colleges offering health informatics programs, from three to ten.<sup>22</sup> The HEP roadmap outlines the proposed workforce job structure for HEP staffing in different types of HPs to ensure an adequate number and mix of health professionals to implement respective HEP packages.<sup>5</sup></p>



## Data flow

Each level in the health system is expected to report monthly, quarterly, and annually on 133 core health indicators. While a standardized patient register form exists for iCCM for children under 5 years old, which includes malaria CCM, there is no standardized reporting register for older patients. The data being collected vary based on the design of the registers for patients over 5 years old. Currently, most HEWs use the paper-based Family Folder, a data collection and documentation tool that contains information on each household. The Family Folder is part of the CHIS, which also includes tally sheets and service delivery reports (monthly, quarterly, and annual). Traditionally, data have been collected using paper forms by HEWs and at HPs and then uploaded via aggregate monthly reports to the country's DHIS2-based routine HMIS on computers at HCs or hospitals.<sup>14</sup> Malaria morbidity and mortality data are collected at health facilities and aggregated for submission to the district.<sup>6</sup>

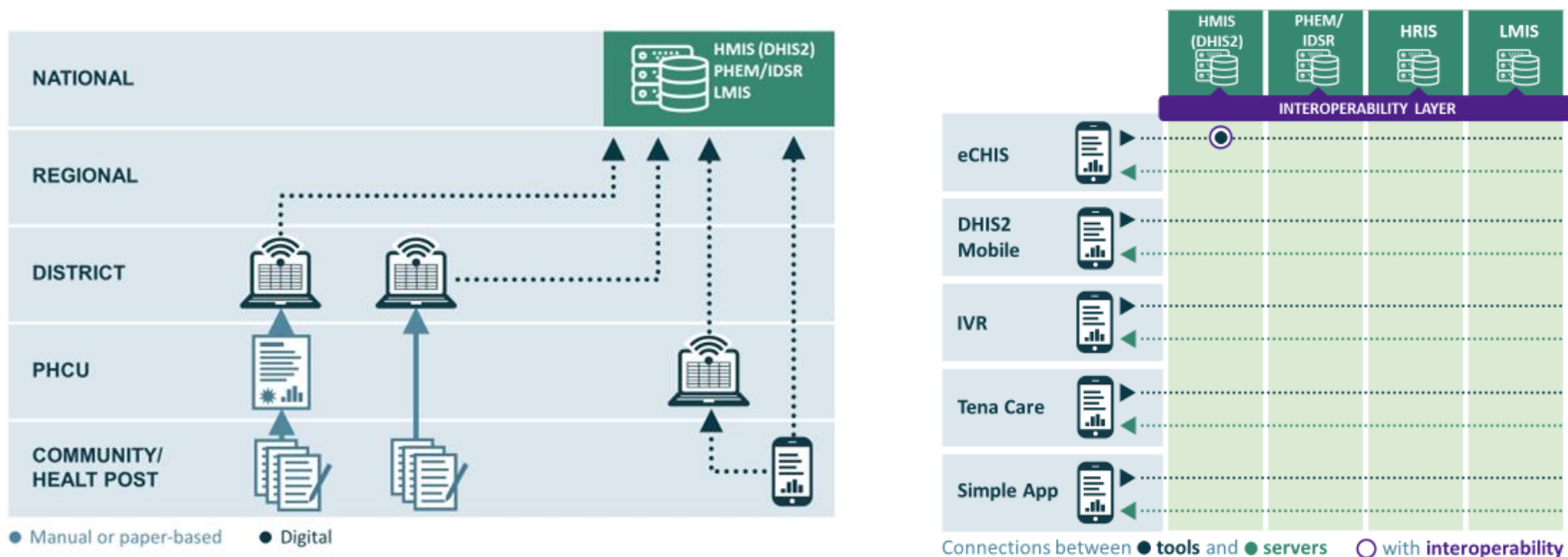
The FMOH has started the transition from paper-based CHIS reporting to use of the eCHIS in selected regions (approximately 6,500 HPs or *kebeles*). Currently, DHA is piloting the process of sending aggregate monthly data from the eCHIS to DHIS2 using OpenHIM (Health Information Mediator). Once this process is fully implemented, the manual process of having HC staff enter eCHIS data into DHIS2 will be eliminated. For HEWs with Internet connectivity, eCHIS data flow through the eCHIS server, which is connected to HealthNet, a virtual private network that connects health facilities and administrative health units in Ethiopia and that can be accessed by users at the HC level and above. Without Internet connectivity, data flow between HEW tablets and an HC, which then transmits the data to HealthNet. Since eCHIS is not fully supporting health services, some health data are still being transmitted manually, even in eCHIS-deployed regions.<sup>13</sup> The malaria data collection module in eCHIS is currently in the pilot phase and includes collection of malaria case management and surveillance data, including case-based surveillance and foci investigation.<sup>8</sup> Additionally, the Malaria Control and Elimination Partnership in Africa project in the Amhara Region previously used mobile phones to collect and report weekly malaria data in DHIS2. The project ended in 2018, and mobile phones are no longer used for this purpose. Challenges in data flow from the community level include errors in tallying data from paper reporting forms, leading to inconsistent and inaccurate data, as well as ineffective feedback mechanisms to address data quality issues.<sup>7,10</sup> In addition, the DHIS2 platform is not inclusive of all essential data elements and indicators; for example, malaria data in DHIS2 do not include referral for severe malaria cases, although those data elements are collected in hard-copy registers in health facilities.

In addition to the CHIS, other point-of-service information systems used for reporting at the health facility level include electronic medical records (EMRs) and laboratory information systems. For the national logistics management information system (LMIS), data collection and reporting are done using a paper-based system, and then data are migrated to a stand-alone electronic system at the district level and above, which is managed by RHB and FMOH staff.<sup>1,2</sup> HEWs are using paper bin cards to monitor commodity stock. Currently, a facility-based LMIS called Dagu has been implemented in 550 health facilities with the plan to further scale to around 900 facilities within the next year. A new version of the national Human Resource Information System has been developed and implementation has started. *Woreda-* and facility-level human resource administration modules are included to cover all health care workers, including HEWs. The PHEM manages the surveillance and control data for 20 diseases, which are either epidemic, targeted for eradication, or of public health importance. At the district level, health officers use SMART (Specific, Measurable, Appropriate, Realistic, and Timely) PHEM, phone calls, or paper forms for sending weekly PHEM reports on morbidity and mortality data from HPs, HCs, and hospitals.<sup>2,13</sup> SMART PHEM is an Excel-based system for collecting PHEM indicators from HCs and HPs. The system is operational in the Amhara Region and will be replaced by a DHIS2 version of PHEM



once it is stable. Malaria is one of the weekly reportable diseases, and malaria indicators comprise a significant proportion of the PHEM indicators (i.e., number of clinical malaria cases, both outpatient and inpatient; confirmed malaria cases by species; and severe malaria cases).<sup>23</sup>

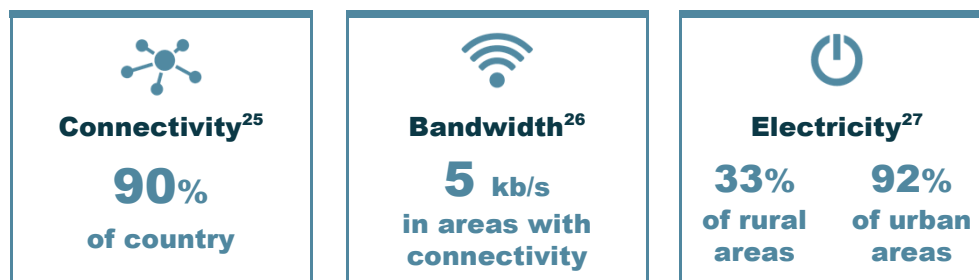
Currently, many HIS in Ethiopia are not integrated; however, there are efforts to develop an eHA and interoperability roadmap as part of the digital health blueprint. The digital health blueprint is finalized and approved already by the FMOH, but discussion is still underway on whether a separate interoperability roadmap is needed. The FMOH draft roadmap is intended to outline the different components and mechanisms to enable digital health data exchange and create a harmonized system for integration and standardization of digital health information.<sup>17</sup> The FMOH has adopted an interoperability layer using OpenHIM, which has been deployed between DHIS2 and the MFR, the Human Resource Information System and the MFR, and more recently, EMRs and DHIS2. EMR, eCHIS, and DHIS2 are developed to be interoperable.<sup>8</sup> DHIS2 Mobile is not yet operational as a HEW tool but is planned for deployment with HEWs to report PHEM data into DHIS. However, eCHIS is intended to be the main tool for case-based surveillance at the community level. All data are housed at the national level, and the Health Data Depot serves as a data warehouse for aggregation and reporting of health data.<sup>15</sup> HealthNet was established in 2018 to connect 3,600 health facilities and administrative health units to a virtual private network as a larger effort to implement the Health Sector Transformation Plan (HSTP) Information Revolution Agenda. This has enabled monthly HMIS report submission by HCs, and in some of the places it is also being extended to labs for data submission to the national laboratory information system and LMIS. In addition, WoredaNetwork (WoredaNet) is an information and communication technology (ICT) infrastructure deployed by the Ministry of Communication and Information Technology to enable data-sharing, voice, and video communications across government agencies.<sup>15</sup> However, WoredaNet has been plagued by slow speed and degradation in service due to limited bandwidth capacity.<sup>24</sup> In terms of data management infrastructure, the database server, application server, and proxy server are all separate and monitored regularly.<sup>10</sup>



**Abbreviations:** DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; HMIS, Health Management Information System; HRIS, Human Resource Information System; IDSR, Integrated Disease Surveillance and Response; IVR, Interactive Voice Response; LMIS, Logistics Management Information System; PHCU, Primary Health Care Unit; PHEM, Public Health Emergency Management.

## Digitally enabling infrastructure

Ethiopian Telecommunications (Ethio Telecom) was historically the sole telecommunications company in Ethiopia working to expand mobile network connectivity across the country. Previously, Ethio Telecom was completely state owned; however, efforts are ongoing to move toward partial privatization.<sup>28</sup> In 2018, Ethio Telecom began partnering with a private-service provider, G2G Clarity SC, to provide Internet services. WebSprix became the first private Internet provider in Ethiopia in 2020, and starting in 2022, Safaricom also will begin operating as a private telecom provider. Network, voice, and 2G mobile Internet reaches almost all *woredas*, while 4G is available in most regional cities, and scaling of 4G is ongoing.<sup>15</sup> Historically, Ethiopia's ICT private-sector market has faced challenges due to the degree of government control and strict regulations, in addition to lack of transparency and open processes to awarding bids for new ICT and software projects.<sup>29</sup> It is anticipated that recent expansion in the Internet services market will improve telecommunication service quality, coverage, and innovation. Coverage of electrical power is disparate and scattered based on land topography and degree of urbanization, leading to a large urban-rural divide in access to electricity, as well as network coverage. HEP staff report unreliable power supply at HPs and HCs. Although some HEWs are provided with solar chargers, the chargers tend to be of poor quality, and digital tools are often recharged at *woreda* health offices.<sup>13</sup> The FMOH has been investing in health infrastructure, including equipping over 450 HCs and 1,100 HPs with solar energy.<sup>21</sup>



In Ethiopia, gaps in network coverage, affordability, and quality prevent progress in adoption of digital solutions.<sup>20</sup> Infrastructure constraints have prevented scaling of a national HIS. Currently, the lowest level of widespread DHIS2 implementation is in HCs, since HPs often lack electricity and hardware and, therefore, cannot support use of DHIS2. As of 2021, 3,600 out of approximately 3,700 HCs were connected via HealthNet, and improvements are expected in the coming year.<sup>11</sup> Initially HealthNet was paid for using contributions from the Global Fund, but the FMOH is now funding the subscription. About 87 percent of hospitals and 92 percent of district health offices are connected to HealthNet, and the eCHIS is being designed for handheld tool and tablet use by HEWs working at HPs. Almost 50 percent of HPs have access to Internet coverage,<sup>12</sup> and eCHIS data sync will take place via a server when there is a connection or when health staff are visiting areas with network coverage.<sup>10</sup> However, there is concern that this will lead to a backlog in data entry and data quality issues.<sup>1</sup> Across the health system, a Health Information Technicians structure exists in all district health offices, hospitals, and HCs. However, the capability of technicians working in these areas varies, and dedicated staff are not in place to address technical issues with HEW use of digital tools. Additionally, no specific management guideline or written protocol exists on how to use or replace lost or damaged digital tools.<sup>13</sup>

## Digital health tools in use and functionality

HEWs in Ethiopia have used a number of digital health tools to facilitate CCM and conduct surveillance. An eHealth Apps Inventory was developed by the FMOH and published in 2018, outlining the existing digital tools in Ethiopia.<sup>30</sup> The eCHIS is intended to be the main national digital tool to be used by HEWs, and it includes the full HEP package based on FMOH priorities. Currently, the eCHIS is not interoperable with DHIS2, meaning data entry takes place in both systems; however, the system was established to be interoperable, and data transfer from eCHIS to DHIS2 is expected to happen eventually. The eCHIS user interfaces are translated into all major local languages but limit data entry to drop-down menu options, except for names and numbers.<sup>13</sup> Additional tools for HEWs exist but are not scaled widely across Ethiopia and are not connected to each other.<sup>7</sup> DHIS2 Mobile and IVR have been used by HEWs in the past but are not currently operational. These tools are planned for deployment for PHEM once DHIS2 for PHEM is active and stable. Most digital tools are used at HCs or higher levels of the health system, including the TenaCare Simple App. The FMOH is interested in extending TenaCare to HPs and has plans to expand Simple App to HPs based on the success of current pilots.

USE CASE(S)	eCHIS	DHIS2 Mobile	IVR	Simple App
Providing malaria community case management	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tracking malaria proactive and reactive case detection	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tracking malaria screening with referral	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transmitting messages to community on malaria	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Training health workers	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tracking routine LLIN distribution during ANC or EPI visits	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

= Current use     = Possible, but not currently in use     = Does not meet use case

Abbreviations: ANC, antenatal care; DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; EPI, Expanded Program on Immunization; IVR, Interactive Voice Response; LLIN, long-lasting insecticidal net.

CASE MANAGEMENT FUNCTIONALITIES	eCHIS	DHIS2 Mobile	IVR	Simple App
<b>Aggregate case reporting and analytics</b> Tool collects aggregate case data and has data analytic functions in tool or online	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Individual case entry and analytics (<i>important in low-burden or elimination settings</i>)</b> Tool collects individual case data and has data analytic functions in tool or online	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Case geolocation (<i>important in low-burden or elimination settings</i>)</b> Tool allows collection or use of geospatial data for individual cases	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Interoperability with HMIS</b> Tool sends information to the official national health information system	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Offline capability</b> Tool functions, at least partially, offline	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Abbreviations: DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; HMIS, Health Management Information System; IVR, Interactive Voice Response.

MANAGEMENT & SUPERVISION FUNCTIONALITIES	eCHIS	DHIS2 Mobile	IVR	Simple App
<b>CHW identification</b> Tool uniquely identifies CHWs	■	■	□	□
<b>CHW catchment location</b> Tool identifies CHW associated position in org unit hierarchy/link to health facility/system	■	■	■	■
<b>CHW performance analytics</b> Tool has analytic functions (data validation, graphs, charts) that support data quality, quality of care, or other performance issues	■	■	■	□
<b>Communication</b> Tool allows two-way communication between peer groups, associated health facilities, or supervisors	■	□	□	□

■ = Current functionality    ■ = Possible, but functionality not currently in use    □ = Does not have functionality

*Abbreviations:* CHW, community health worker; DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; IVR, Interactive Voice Response.

# Appendices

APPENDIX A ► **References**

APPENDIX B ► **Abbreviations**

APPENDIX C ► **Contributors**

APPENDIX D ► **Community digital health tools**

APPENDIX E ► **Next-generation tool functionalities for malaria case management**

APPENDIX F ► **Extended recommendations**



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## APPENDIX A

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## APPENDIX B

### Abbreviations

ANC	antenatal care
CCM	community case management
CHIS	Community Health Information System
CHW	community health worker
DHA	Ethiopia Digital Health Activity
DHBp	National Digital Health Blueprint
DHIS2	District Health Information Software 2
eCHIS	electronic Community Health Information System
eHA	eHealth Architecture
EMR	electronic medical record
EPI	Expanded Program on Immunization
FMOH	Federal Ministry of Health
HC	health center
HEP	Health Extension Program
HEW	health extension worker
HIM	Health Information Mediator
HIS	health information system
HIV	human immunodeficiency virus
HMIS	Health Management Information System
HP	health post
HRIS	Human Resource Information System
HSTP	Health Sector Transformation Plan
iCCM	integrated community case management
ICT	information and communication technology
IDSR	Integrated Disease Surveillance and Response



IT	information technology
ITN	insecticide-treated net
IVR	Interactive Voice Response
JSI	John Snow, Inc.
LLIN	long-lasting insecticidal net
LMIS	logistics management information system
M&E	monitoring and evaluation
MACEPA	Malaria Control and Elimination Partnership in Africa
MFR	Master Facility Registry
NMEP	National Malaria Elimination Program
NMSP	National Malaria Strategic Plan
PHCU	Primary Health Care Unit
PHEM	Public Health Emergency Management
PMI	U.S. President's Malaria Initiative
PPMED	Policy, Planning, Monitoring and Evaluation Directorate
RHB	regional health bureau
SMART	Specific, Measurable, Appropriate, Realistic, and Timely
SNNPR	Southern Nations, Nationalities, and People's Region
TWG	technical working group
USAID	US Agency for International Development
WDA	Women Development Army
WEEMA	Water, Education, Economic empowerment, Medical care and Alliance
WHO	World Health Organization

## APPENDIX C

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*Abbreviations:* FMOH; Federal Ministry of Health; PMI, U.S. President's Malaria Initiative; PPMED, Policy, Planning, Monitoring and Evaluation Directorate; USAID, US Agency for International Development.

## APPENDIX D

### Community digital health tools\*

Name of Tool	Type of Digital Health Intervention†	Implementer (Funder)	Scale	Malaria Use Case
<b>eCHIS</b>	<p>2.2 Client health records</p> <p>2.5 Health provider communication</p> <p>2.6 Referral coordination</p> <p>4.1 Data collection, management, and use</p> <p>4.3 Location mapping</p>	FMOH, JSI, Dimagi (US Agency for International Development)	~1,400 health posts in Oromia, SNNPR, Amhara, and Tigray, with plans to scale nationally	<p>Providing malaria community case management</p> <p>Tracking malaria proactive and reactive case detection</p> <p>Tracking malaria screening with referral</p> <p>Transmitting messages to community on malaria</p>
<b>DHIS2 Mobile</b>	4.1 Data collection, management, and use	MACEPA/PATH (Bill & Melinda Gates Foundation)	N/A – No longer active	Tracking malaria proactive and reactive case detection
<b>IVR</b>	4.1 Data collection, management, and use	JSI	N/A – No longer active	Tracking routine LLIN distribution during ANC or EPI visits
<b>Simple App</b>	<p>2.2 Client health records</p> <p>2.3 Health care provider decision support</p> <p>4.1 Data collection, management, and use</p>	Vital Strategies (Resolve to Save Lives)	Addis Ababa, Amhara, Dire Dawa, Oromia, SNNP, Somali and Tigray regions	N/A
<b>OppiaMobile</b>	2.8 Health care provider training	Digital Campus	Tigray region	Training health workers
<b>Hiwot</b>	<p>2.6 Referral coordination</p> <p>4.1 Data collection, management, and use</p>	FMOH, WEEMA International, D-Tree International	SNNP region	Training health workers
<b>Open Data Kit</b>	4.1 Data collection, management, and use	MACEPA/PATH (Bill & Melinda Gates Foundation)	N/A – No longer active	Tracking malaria proactive and reactive case detection

\*Data that come from the survey have not been independently validated aside from tools featured within the profile.

†See [Classification of digital health interventions v1.0](#), World Health Organization, 2018.

*Abbreviations:* ANC, antenatal care; DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; EPI, Expanded Program on Immunization; FMOH, Federal Ministry of Health; IVR, Interactive Voice Response; JSI, John Snow, Inc.; LLIN, long-lasting insecticidal net; MACEPA, Malaria Control and Elimination Partnership in Africa; SNNPR, Southern Nations, Nationalities, and Peoples Region; WEEMA, Water, Education, Economic empowerment, Medical care and Alliance.

## APPENDIX E

### Next-generation digital health tool functionalities for malaria case management

CASE MANAGEMENT FUNCTIONALITIES	eCHIS	DHIS2 Mobile	IVR	Simple App
<b>Notifications</b> Tool sends and receives notifications	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Stock reporting &amp; analytics</b> Tool collects stock data and has analytic functions to support stock and logistics data analysis and decision-making	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Interoperability with other national health systems</b> Tool sends information to other national systems (iHRIS, LMIS, etc.)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Referral coordination</b> Tool allows CHW to notify local health facility of referrals and track them	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Scheduling &amp; work planning</b> Tool allows CHW to plan and schedule key activities in the community	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

*Abbreviations:* CHW, community health worker; DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; iHRIS, integrated Human Resource Information System; IVR, Interactive Voice Response; LMIS, logistics management information system.

MANAGEMENT & SUPERVISION FUNCTIONALITIES	eCHIS	DHIS2 Mobile	IVR	Simple App
<b>Decision support</b> Tool provides algorithms or checklists to guide CHW service provision	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Training materials &amp; resources</b> Tool provides access to training materials, policies, or other useful reference documents	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>CHW geolocation</b> Tool allows collection or use of CHW geolocation data for monitoring and planning distribution	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Supervision</b> Tool can be used by supervisors to assess CHW skills and capacity	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

= Current functionality     = Possible, but functionality currently not in use     = Does not have functionality

*Abbreviations:* CHW, community health worker; DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; IVR, Interactive Voice Response.

## Extended recommendations

### 1.1 HEWs and supervisors have the necessary skills and are appropriately equipped to provide febrile illness management, where needed

#### Description

- There is adequate coverage of HEWs according to national guidelines, so that every area requiring HEW support has HEWs available, but there is a desperate need for technical support for digital health, training on digital health tools, and digitalization of reporting.
- HEWs and supervisors are trained in febrile illness management.
- HEWs have the commodities and equipment needed to provide febrile illness management services.
- HEWs are routinely providing febrile illness management services.
- HEWs have access to job aids and decision-support tools and are routinely supported through supervision visits, according to national guidelines.
- Supervisors have access and respond to feedback from communities and HEWs to continuously improve skills.

#### Recommendations

- Support assessment/evaluation of HEW program implementation to describe impact and inform areas for improvement.
- Streamline multiple basic and refresher training curricula into a single HEW training package and leverage blended learning approaches including online learning tools.
- Develop/implement/scale training content on HEW malaria and febrile illness management; use innovative approaches, including remote and interactive training techniques (e.g., Moodle, OppiaMobile, LEAP) for job shadowing at health facilities; integrate into ongoing skill-building programs, where possible.
- Develop/fund/implement feedback loop from communities and HEWs to supervisors for ongoing, continuous improvement/skill building.

### 1.2 Guidance, training, and ongoing technical support is available for digital tools and data use

#### Description

- There are staff with clear roles and responsibilities and a hierarchy from the local to the national level for IT support, including dedicated technicians and a Help Desk, Human Resource Information System support, and support for data use.
- There is documented guidance on how data can be used to guide decision-making from the local to the national level, such as M&E plans and data-to-action frameworks.
- HEWs are trained and motivated to use digital tools, and training is a part of routine pre-service and in-service training.
- HEWs and staff at all levels are trained in data use for decision-making.

#### Recommendations

- Identify capacity of existing staff and local IT providers (including those established by the Digital Health Activity project through local IT youth enterprises) to provide day-to-day digital and data use support from the local to the national level.
- Develop/fund/implement comprehensive IT and data use support structures from the local to the national level.
- Develop M&E plans and data-to-action frameworks, in collaboration with HEWs, to support data use and ensure that indicators and dashboards are responsive to HEW needs.
- Develop training curricula for HEW use of digital tools and data for decision-making and incorporate into existing HEW curricula.

- In-country capacity exists to adapt, configure, and support the implementation of hardware and software.
- Training and technical support effectiveness is continuously enhanced by HEW feedback and iterative improvements based on that feedback.
- Develop/fund/scale innovate skill-building approaches to support use of digital tools and data for decision-making (e.g., WhatsApp groups to ask questions on tool functions and to discuss/share progress toward performance goals) and support data interpretation.
- Identify and engage in-country partners and global goods providers that have the capacity to adapt, configure, and support implementation of the hardware and software.
- Develop feedback and evaluation processes to continuously strengthen training and technical support programs.

### 1.3 Data generated by HEWs are used to reduce burden of febrile illnesses

#### Description

- Data review meetings are routinely held at all levels to ensure high-quality data capture and high data comprehension.
- Data management costs (e.g., transport and/or airtime for data review meetings) are incorporated into budgeting exercises.
- All levels, from HEW to national, regularly use data to guide key decisions (e.g., requesting commodities, scheduling activities, monitoring data completeness and quality, monitoring HEW performance, and targeting interventions).
- Data feedback loops are established and maintained to improve data quality, including communication mechanisms to understand data-driven decisions and changes made to implementation to allow sharing and scaling of best practices.

#### Recommendations

- Assess existing barriers to HEW data use at all levels of the health system.
- Conduct data quality audits of HEW data, using national and WHO malaria and health systems data quality audit guidelines.
- Strengthen systems to optimize/incentivize data use, such as regular feedback and accountability mechanisms and recognition of data use, as well as automated data analytics aligned with current efforts in the Data Use Partnership project (see sections 2.1–2.3 below).
- Document/evaluate data use to monitor progress and best practices and identify opportunities for improvement; involve HEWs.
- Develop protocols and feedback mechanisms to improve data completeness, accuracy, and timeliness.

### 2.1 National HEW policy and guidance exist, include febrile illness management, and are implemented

#### Description

- National HEW policy and guidance exist and include a standardized package of care.
- HEW policy describes HEWs' role in malaria case management.
- HEW program is funded.
- HEW policy is being implemented consistently throughout the country with a standardized package of care.

#### Recommendations

- Develop HEW program funding strategy, incorporating input and long-term strategies of implementing partners and donors.
- Develop streamlined implementation strategy (vs. fragmented program-specific strategies).
- Develop coordinating body to coordinate across programs/partners.
- Support M&E plans for policy implementation to improve effectiveness.

## 2.2 National digital health strategy and policies exist and are implemented

### Description

- Digital health strategy exists.
- Digital health policies exist to guide:
  - Governance (digital health and health data governance roles, responsibilities, and structures).
  - Data management (data access, privacy, security, and confidentiality and data-sharing guidance).
  - Standards and interoperability (enterprise architecture, normative standards, and digital identity).
  - Infrastructure (data hosting and storage [e.g., local or cloud], mobile device management, and telecommunications access).
  - Workforce (job structures and descriptions, plans for capacity-building, digital literacy expectations, and incentives for digital adoption).
- A robust, transparent procurement process supports national decision-making within governing bodies around digital tools used to support health systems.
- The strategy and policies are implemented and enforced.

### Recommendations

- Support assessment/evaluation of strategy and policy implementation and enforcement to improve effectiveness.
- Support digital data leadership, management, and governance training.
- Develop a robust, transparent digital hardware and software procurement process to support governing bodies in their decision-making.
- Develop private-sector partnerships to support the funding/scaling of HEW use of digital tools.

## 2.3 National digital health and community health strategies and policies are aligned and support each other

### Description

- Digital health strategy references community health strategy and management of febrile illness.
- Community health strategy references digital health strategy and includes management of febrile illness.
- HEWs and the National Malaria Elimination Program use the digital health strategy and policy to inform use of digital tools in community-level malaria interventions.

### Recommendations

- Support HEW program to align to national digital health strategy and the *National Digital Health Blueprint*.
- Strengthen national eCHIS digital health tool coordinating body/technical working group by including partner representatives and regional government stakeholders.



- There is a coordinating body that meets regularly to discuss and plan HEW program use of digital tools, comprising HEW, malaria and digital health program, and partner representatives.
- HEW guidance on the use of digital tools are implemented and enforced.

### 3.1 There are clear febrile illness data flows between HEW source data and the national data warehouses

#### Description

- It is clearly documented how HEW data flow into the national data warehouses, including which systems are used (paper or digital), which data are transferred, and what the roles, responsibilities, and reporting requirements are at each level.
- All HEW-collected data regularly flow into the national data warehouses for storage and use, with minimal errors, disruptions, or downtime.
- HEW-collected data are complete, accurate, and timely.
- A strong metadata management plan is in place and implemented to ensure up-to-date registry information in the national data warehouses (e.g., HEWs roster, Master Facility Registry).
- A software solution for data analytics and visualization exists that incorporates data security and data governance principles to implement access control and permission to protect sensitive information.

#### Recommendations

- Clarify roles and responsibilities for data management and reporting requirements.
- Develop protocols and feedback mechanisms to improve data completeness, accuracy, and timeliness.
- Coordinate plans to support ongoing efforts to digitalize data warehouse systems.
- Develop organizational procedures and policies for cleaning, managing, storing, and sharing data.
- Identify and implement software solutions for data analytics and visualization across different systems. Support the development of dashboards by pooling data from eCHIS, PHEM/DHIS2, HMIS/DHIS2, LMIS, National Disaster Risk Management, and satellite/ground station data on climate/environment, including antimalaria intervention coverage data, to visualize malaria risk to strengthen feedback loops to the most granular levels and motivate end users for action.
- Develop automated data quality analytics into data pipeline and warehousing system.
- Develop organizational procedures and policies for metadata management and updates.

### 3.2 Digital health tools are sustainable, adaptable, and aligned with national interoperability standards

#### Description

#### Recommendations

- Digital health tools currently in use and prioritized by the government for use in HEW programs are:
  - Sustainable (have a strong user community, a large user group, in-country technical support for software maintenance and development, and government endorsement and ownership and are affordable).
  - Adaptable (designed to be flexible enough to accommodate ongoing demands for additional functionalities and scalable for use at a national level).
  - Aligned to interoperability standards (can exchange data with national health systems and have a data dictionary and data use and exchange documentation).
- Support NMEP on the implementation of the advanced eCHIS malaria surveillance system and response including monitoring and evaluation of the malaria elimination interventions.
- Support NMEP implementation of interruption of residual malaria transmission (case and foci investigation).
- Ensure synchrony of the passive case detection in the public/private facilities with the reactive case detection through the advanced surveillance system.

### 3.3 Digital health tools are fit to context, have foundational HEW febrile illness management functionalities, and are used where needed

#### Description

- Digital health tools meet user needs and changes in user needs over time, in terms of both hardware (i.e., maintaining charge) and software functionalities required.
- Digital health tools are regularly reviewed to ensure that they meet HEW ongoing needs; the review includes HEW input and user-centered design principles.
- Tools incorporate foundational and, where necessary, advanced functionalities.
- Digital tools are used nationally through all HEW programs that provide malaria services.
- Digital health tools that support malaria case management services are integrated into a single tool that supports multiple health care programs (i.e., maternal and child health, HIV), wherever possible.

#### Recommendations

- Support data quality through routine data quality audit.
- Ensure an advanced surveillance system through continuous improvement of data element and indicators for all the priority reportable diseases.
- Support NMEP on the development of village-level malaria risk mapping (stratification) to inform village-level interventions: burden reduction versus interruption of residual transmission.
- Support the evidence-based village-level microplanning for equitable antimalaria resources allocation.
- Monitor village-level oscillations of malaria morbidity to track epidemics and respond accordingly.

*Abbreviations:* DHIS2, District Health Information Software 2; eCHIS, electronic Community Health Information System; FMOH, Federal Ministry of Health; HEW, health extension worker; HMIS, Health Management Information System; IT, information technology; LMIS, Logistics Management Information System; M&E, monitoring and evaluation; NMEP, National Malaria Elimination Program; PHEM, Public Health Emergency Management; WHO, World Health Organization.