PMI | U.S. PRESIDENT'S MALARIA INITIATIVE
LED BY USAID FROM THE AMERICAN PEOPLE | CDC

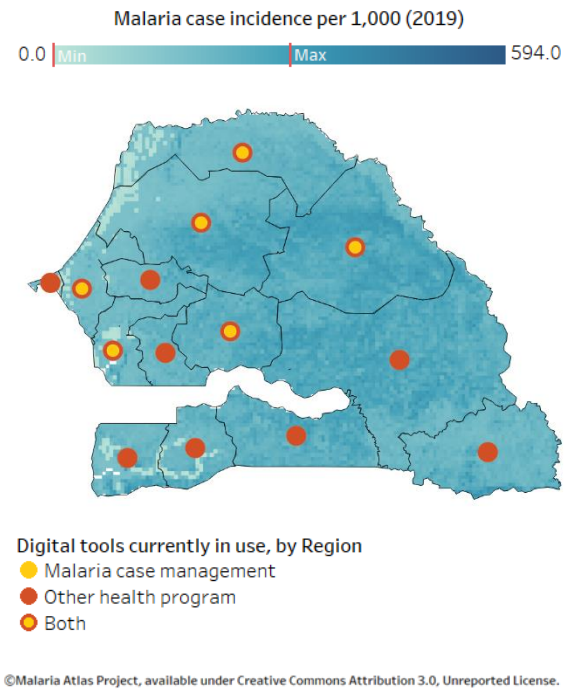
Role of Digital Tools in Fighting Malaria at the Community Level

SENEGAL

Executive Summary

Due to a heterogeneous malaria burden, Senegal's Programme National de Lutte contre le Paludisme (PNLP), or "National Malaria Control Program," is stratifying its intervention approach. Interventions in the northern Sahel region focus on pre-elimination and elimination in high- and low-burden areas, respectively, while interventions in southern Senegal focus on prevention and treatment. In Senegal, multiple cadres of community health workers (CHWs) deliver preventative and curative services, including malaria case management: *agents de santé communautaire* (ASCs), or "community health workers," *dispensateurs de soins à domicile* (DSDOMs), or "home-based care providers," *matrones* (matrons), and ASCs/matrones. Several community-level digital tools are being deployed (e.g., for disease notification and investigation of malaria cases). Senegal is planning to extend the use of the District Health Information Software 2 (DHIS2) Capture for aggregate case reporting at the community level.

The Ministère de la Santé et de l'Action Sociale (MSAS), or "Ministry of Health & Social Action," has a digital health (DH) strategy, coordination body, and list of digitalization projects (down to the community level) that are considered a national priority. Current recommendations involve opportunities to enhance national ownership and strengthening long-term sustainability of digital community health initiatives.



MALARIA

Incidence per 1,000 people in 2020[4]

26.7

PEOPLE

Community Health Workers (CHWs)

33,039 CHWs[1]

5.8 per 10,000 people (for ASCs/DSDOMs/matrones)

GOVERNANCE

National Digital Health Strategy

YES[2]

SYSTEMS

Digital Health Index[3]

SCORE: 2

digital square

Recommended Actions

Please see Appendix F for an extended version of these recommendations.

PEOPLE

CHWs and decision-makers

Deeper assessment on CHW needs

Conduct an in-depth assessment to better assess CHW user needs, current workload, technical capacity, and digital literacy to support malaria case management and care. This should include a mapping of CHWs to facilities and district health centers.

Develop a standardized DH training module for ASC/DSDOM/matrones

Support the technical working group (TWG) (see recommendation in the governance section) to develop a digital health (DH) training module for integration into the training curricula for ASC, DSDOM, and matrone. Support the TWG to develop and deploy the DH training module to increase CHW capacity.

Strengthen DH technical support at the regional and district levels

Identify and train CHW supervisors who can provide basic technical and software support directly to ASCs/DSDOMs/matrones. Establish a help desk to streamline technical requests from subnational health staff.

Develop a plan for improving malaria data quality/use for the peripheral levels of the health system

Develop a system with key performance indicators to analyze and provide feedback to CHWs on data reporting. Include CHWs in district-level data quality audits and trainings on data use and quality. Create feedback evaluation procedures to ensure refresher training is focused appropriately.

GOVERNANCE

Strategies and policies

Strengthen oversight/governance functions of the Cellule de la Carte Sanitaire et Sociale, de la Santé Digitale et de l'Observatoire de la Santé (CSSDOS), or "Health and Social Map, Digital Health and Health Observatory Unit"

Assess the barriers to and potential solutions for CSSDOS oversight of DH coordination for CHWs, leading to a meeting of partners to support the CSSDOS in setting oversight guidance and strategizing the way forward for implementation efforts (e.g. common workplan development).

Develop a TWG and coordination work plan to guide digitalization at the community level

Include in the work plan the membership, affiliations, roles, responsibilities, requirements, a timeline, and short- and long-term desired outcomes. The comprehensive work plan would support current digitization efforts and data-use initiatives, as well as guidance for digital community health tools to adhere to the national architecture.

Support DH enterprise architecture (EA) and policy documents

Facilitate a review process with *l'Agence de l'Informatique de l'État (ADIE),* or State Information Technology Agency, to create standards and develop a national DH EA. Create an advocacy plan for the next level of DH policies.

SYSTEMS

Processes and digital tools

Support ongoing efforts to digitalize monthly case reporting for ACs cadres through the DHIS2 Capture application

Develop a costed plan to fill the current gaps in scaling DHIS2 Capture among CHWs. The plan would include purchasing hardware; providing training, maintenance, and post-training supervision; configuring reporting forms; inserting a community structure in DHIS2; and developing implementation work plans.

Identify potential digital tools for ASC/DSDOM/matrone supervision and commodities management

Hold a meeting to evaluate the configuration of supervisory functionality as well as commodities management functionality of potential community digital tools.

Develop an interoperability layer to connect all current and future tools and subsystems

Organize meetings with partners to discuss ways to modify existing tools to merge the data repository portions with the DHIS2 platform.

Work with the MSAS to nationalize a malaria case management tool that is interoperable with DHIS2

Identify the appropriate reporting tool for the national individual reporting system for malaria case investigation and case management.

Methodology

PATH compiled this profile through consulting various data sources (desk review, survey, interviews) and reviewing them during a workshop between September 2020 and January 2021. Documents consulted are listed in Appendix A, and interviewees / workshop participants are listed in Appendix C.

DESK REVIEW

Between **September 2020** and **February 2021**, **19** documents were reviewed to establish a foundation of knowledge on the malaria strategy, community health program(s), governance, data systems and architecture, role of data in decision-making, and infrastructure.

SURVEY

In **October 2020**, a survey was sent to **25** stakeholders at all levels of the health system: global policymakers, funders, and private-sector partners. The survey was open for three weeks and received 17 responses.

INTERVIEWS

Interviews were conducted with **8** individuals from organizations such as **PATH and the MSAS** during **November 2020**. Additionally, a focus group with CHWs was conducted, and notes from separate assessments done by partners and PATH staff were consulted (see Appendix B).

WORKSHOP

A workshop was conducted with **21** participants in **January 2021**. The workshop comprised two virtual sessions that included representatives from the PNLP and CSC. The aim was to validate results from previous steps and identify opportunities for digital tools to increase malaria program impact.

ANALYSIS

Following the workshop, the team reviewed each step's output and developed a country profile highlighting recommendations developed in consultation with key partners. Data were last collated on **June 30, 2021**.

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 CHW use of digital tools for malaria case management, a state in which community health programs can leverage digital tools to generate and use data that improve malaria programming with the ultimately aim to decrease 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

In Senegal, there are two main types of CHW cadres: the *agent communautaire de santé promotion et prévention* (ACPP), or "community promotion and prevention worker," responsible for information, education, and communication activities; and the *acteur communautaire de soins* (ACs), or "community care actor," responsible for delivering packages of preventive and curative services.

ACPPs include *praticiens de la médecine traditionnelle* (traditional medicine practitioners), *bajenu gox* (roughly translating to "godmothers"), and *relais communautaires* (community relays or liaisons) and total 23,689.[1] While ACPPs conduct behavior change communication activities on a range of health issues, including malaria, they do not provide malaria community case management. ACPPs work on a voluntary basis.

ACs workers include ASCs, DSDOMs, matrones (responsible for reproductive and maternal health), and ASCs/matrones (multiskilled workers who perform integrated ASC and matron tasks in a health facility).[1] Of the 9,350 workers employed as ACs, 75 percent provide malaria case management services, including all ASCs/DSDOMs and some matrones.[1,5] ACs coverage is currently at 5.8 per 10,000 people; however, different CHW cadres have different targets based on distance and accessibility. For integrated CVACs the target is 1 per 2,500 people.

33,039 **Community health workers in country**	**Compensation Policy:** **PAID** **Payment varies by cadre**
7,019 **Providing malaria community case management**	**Compensation Policy:** **PAID** **Payment varies by cadre**

ASCs and matrones operate at *cases de santé* (health huts), and DSDOMs provide community case management services within the home through the *prise en charge à domicile* (PECADOM), or "home care," package.[3] The PNLP expanded the PECADOM package in 2013 to include active case detection and treatment during the high-transmission season (PECADOM+), and it has been scaled to 35 districts as of 2019.[6] While most ACs workers work on a voluntary basis, DSDOMs are given financial incentives for implementing PECADOM+. Although PECADOM has been expanded through a phased approach to over 2,000 villages across 14 regions, expansion is limited by available funding and prioritization of all interventions.[7,8] Another bottleneck to expansion is limited availability of supervisory and monitoring capacity at the health post, where most CHWs receive supervision. CHWs are supported by a range of financing partners, including local authorities, the MSAS, the US President's Malaria Initiative, and the Global Fund.[7,8]

Community health worker digital readiness

Eligibility requirements for the ASC/DSDOM cadres include local language literacy and residency.[7,9] Preservice trainings for ASCs/DSDOMs have standardized curricula and include refresher trainings—which are intended to be completed every two years, but this depends on the availability of funding.[9] Preservice curricula are not likely to include training on digital tools. The responsibility for digital tool training is generally left to implementing partners / nongovernmental organizations and varies by cadre.[9] Partners such as PATH, Dimagi, or the US Peace Corps have provided ad hoc training for DHIS2 Capture and CommCare. The implementation of DHIS2 Tracker, which is used by teams that include CHWs to collect community-based case investigation data, includes a comprehensive plan to support digital readiness. The plan includes surveyor eligibility criteria, a user manual, a regional IT engineer, technical support capacity strengthening for district supervisors, and mobile device management. This plan could be used as a model to develop standardized DH training modules, including for refresher trainings, and strengthen DH technical support at the regional and district levels.

Data-driven decisions at each level of the health system

The use of data for decision-making in Senegal's health system is strongest at the national and district levels of the health system. Data-driven decisions are facilitated through annual coordination and review meetings at national and district levels. Opportunities exist for increased data-driven decision-making at more local levels due to availability of data and user-friendly analytical and visualization tools within DHIS2. In addition, decision-support functionalities could be implemented for health workers using DHIS2 at the peripheral levels. Given the role and responsibility of the integrated CVACs to reinforce community surveillance and use of community-level data and tools, these committees have the potential to improve community-level data use and quality by involving CHWs in quality audits and providing trainings, incentives, and feedback on the use of data and digital systems.[10]

NATIONAL LEVEL	Data are aggregated and analyzed, predominantly via DHIS2, for planning and dissemination purposes. Data are used to produce weekly, quarterly, and annual surveillance bulletins which are circulated down to the district executive teams. For malaria, the weekly bulletins are surveillance bulletins based on sentinel sites' data. For quarterly and annual bulletins, these are epidemiological bulletins that report on routine data. Data from the DHIS2 are analyzed by the MSAS's Office of Planning, Research, and Statistics for preparation of national strategic plans and for annual joint meetings where planning and budgetary decisions are made and presented to the National Assembly.
REGIONAL LEVEL	Coordination meetings occur quarterly at the regional level where the Regional Health Directorate reviews routine data from DHIS2 from the district-level and regional hospitals. Regional *revue annuelle conjointe*, or "joint annual reviews," develop regional work plans based on data collected at district, health facility, and community levels.
DISTRICT LEVEL	Coordination meetings occur monthly at the district level. During these coordination meetings, data are reviewed, information is shared across stakeholders, and a plan of action is developed between the district medical officer, health facility staff, and the ICPs (e.g., for planning supervision activities). The coordination meetings offer an opportunity for ICPs to correct data quality issues. These coordination meetings ensure information is shared and decisions can be made on all aspects of system management.
HEALTH FACILITY LEVEL	Data are verified at health posts, health centers, and hospitals during quarterly and biannual supervision meetings. At the health facility level, data are analyzed against previous years to detect outbreaks. Hospitals and referral facilities manage and report on serious cases of malaria. If there are case spikes within the jurisdiction of a health post, the ICP in the affected area may notify the district in order to initiate investigations. Every six months, the ICPs are tasked with conducting a monitoring exercise for all programs under their supervision. For this exercise, they will look at key indicators (e.g., malaria, reproductive health, tuberculosis, financial management, inventory management) and define bottlenecks, which are then shared with CHWs to suggest areas for greater focus and improved service delivery. Bottlenecks are also communicated to the district medical officer if there are gaps that need to be addressed.
COMMUNITY LEVEL	Although data are generally not analyzed for decision-making purposes by DSDOMs or ASCs, they may signal to the ICP if they observe an unusually high number of cases in their catchment area. Routine feedback from the ICPs on data collection and associated disease trends is rarely given to ASCs/DSDOMs. Integrated CVACs are community surveillance committees that are tasked with event-based community surveillance to detect early outbreaks of disease and any unexpected or unusual health events in the community. The committees include community leaders, religious leaders, representatives from cultural and educational groups, community-based organizations, and CHWs (including members of ACs and ACPP cadres).[11] The integrated CVACs host monthly meetings to discuss health events and issues with the ICPs and CHWs and to explore solutions. The mobile platform mInfoSanté is used for exchanges between CVACs and ICPs.[10]

Governance

	DIGITAL	COMMUNITY HEALTH	MALARIA
Name	*Plan Stratégique Santé Digitale (Digital Health Strategic Plan)*	*Plan Stratégique National de Santé Communautaire (National Strategic Community Health Plan)*	*Plan Stratégique National de Lutte contre le Paludisme au Sénégal (National Strategic Plan for the Fight Against Malaria in Senegal)*
Current strategy dates	2018–2023	2020–2024	2021–2025
Coordinating body	CSSDOS	CSC	PNLP
Funding strategy	Yes	Yes	Yes

The MSAS is responsible for overseeing the CSSDOS, CSC, and PNLP. The MSAS governing document outlining Senegal's plan to achieve universal health coverage, the *National Health Development Plan 2019–2028,* features two action items involving digitalization: (1) strengthening the availability and use of health and data (including through the digitalization of community data) and (2) developing innovative digital technologies to support the health system. The plan also outlines a series of goals to accelerate control of malaria, including a focus on management and operational capacities at all levels and early detection of outbreaks through responsive early warning systems.[12] In addition, health projects are featured in the government's overarching digital strategy, Sénégal Numérique (Digital Senegal) 2016–2025. The strategy proposes a budget of US $58 million for development of a national platform for managing patient files, a universal health card, telemedicine, a control system for counterfeit medicine, an emergency communications system for monitoring pregnant women, and deployment of an early warning system to prevent epidemics. The proposed budget has been developed and is awaiting funding. Neither malaria nor febrile illness are explicitly mentioned in Sénégal Numérique.[13]

Senegal has prioritized strengthening community-based data in key policy documents, including the DH, community health, and malaria strategic plans. Senegal's DH strategy is operationalized through a set of projects defined in the Health Sector Digitalization Program, and DH projects are coordinated by the CSSDOS, a body established through decree as a unit within the MSAS.[14] The community data digitalization project is proposed for inclusion in Senegal's Consolidated Investment Budget. A recent assessment observed that awareness of the CSSDOS was limited, that its authority did not go far enough, and recommended strengthening its oversight functions over digital tools.[15] Although national EA, health information system (HIS) standards, and guidelines for interoperability have not yet been defined, the DH strategy does indicate that a framework for norms and interoperability is needed. The CSSDOS has expressed interest in developing these governance elements.

The next iteration of the National Strategic Community Health Plan (2020–2024), currently under validation, includes action items for promoting community data digitalization and strengthening community data flow into the HIS.[1] To build on the work conducted to date, a work plan for digitalization at the community level is recommended for development by a CSSDOS-led TWG.

Within the PNLP's updated National Strategic Plan 2021–2025, objectives exist for strengthening the quality of routine data for monitoring and evaluation and for operational research. The funders and PNLPs of Senegal, Gambia, and Mali also coordinate cross-border initiatives through a memorandum of understanding and the development of action plans.[16]

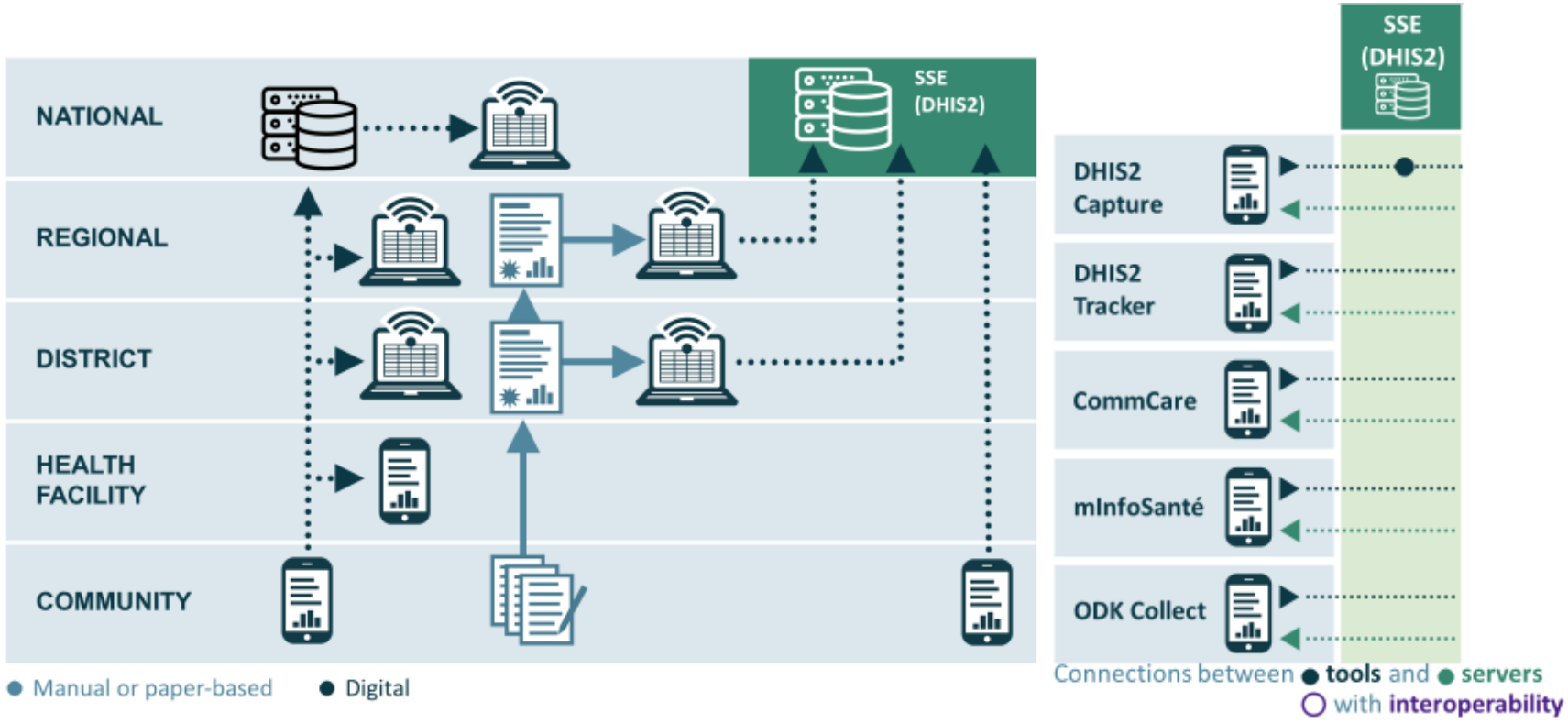
GOVERNANCE Policies define digital health and health data governance roles, responsibilities, and structures.	The Senegalese Information Society's Orientation Law on the Information Society (*loi n° 2008–10 portant loi d'orientation sur la société de l'information*) provides principles for the governance of the use of information and communication technology (ICT) in various sectors (including health). DH is governed by the *Digital Health Strategic Plan 2018–2023*, and the CSSDOS functions as the governance structure for DH projects.
DATA MANAGEMENT Policies provide specifications for data access, privacy, security, and confidentiality and outline stipulations for data sharing.	The Personal Data Protection Act (*loi n ° 2008–12 relative à la protection des données personnelles*) provides a legal framework for the protection of personal data and establishes an independent administrative authority, the Personal Data Protection Commission (la Commission de la Protection des Données Personnelles), to ensure that the processing of personal data is in compliance with the law. The legal framework deserves fortification to better protect personal data as part of DH technology. In addition, in 2017 a presidential order was issued to define the principles and rules governing the Senegalese State Information Systems Security Policy (Politique de Securite des Systemes d'Information de l'Etat du Sénégal).[17]
STANDARDS AND INTEROPERABILITY Policies describe an enterprise architecture, normative standards—such as health information standards—and digital identity.	Senegal has not yet adopted an EA for the health sector, an interoperability layer, a health information exchange platform, or guidelines for standards and interoperability. The Digital Health Strategic Plan (Plan Stratégique Santé Digitale*)* describes the need to develop a framework for HIS standardization and interoperability. The strategy recommends approaching the ADIE to review existing government standards to adapt them to the health sector and to develop a national architecture.
INFRASTRUCTURE Policies define data hosting and storage (e.g., local or cloud), mobile device management, and telecommunications access.	Data hosting and storage is not currently centralized in Senegal, and lack of policies and regulation has led to the proliferation of siloed hosting facilities across different government ministries. However, the new data center in Diamniadio is intended to serve all government sectors including health, in the future. Increased collection and use of community-level data will also increase the need for storage of health data. Efforts by ADIE are underway to construct a government cloud to integrate data storage, but data storage policies will need to be implemented in coordination with ministry and agency IT centers. The Regulatory Authority for Telecommunications and Posts (Autorité de Régulation des Télécommunications et des Postes) drafts policies and issues regulations regarding telecommunications operators, equipment, and conditions for licensing.[18] This includes the Code on Electronic Communications (Code de Communications Electroniques), adopted in 2018 to regulate the electronic communication sector.
WORKFORCE Policies describe workforce job structures and descriptions, plans for training, digital literacy expectations, and incentives for digital adoption.	The Sénégal Numérique 2016–2025 sets targets for job creation within the digital sector, but the country has not yet defined workforce-specific policies related to DH. However, the Government of Senegal has been participating in the ICT Transforming Education in Africa project through supporting ICT in education policy development.[19] Advocacy plans could support development of DH policies aimed at improving digital workforce initiatives.

Systems

Data flow

At the community level, the majority of ASCs and DSDOMs collect and submit paper-based, routine data reports on a monthly basis to the ICP of their respective health post, where the reports are then compiled into a zonal report and entered into the national SSE system. The SSE hosts the Health Management Information System and infectious disease surveillance system and is built on the DHIS2 platform. A recent assessment observed that data entry is time consuming (three to five days per month) for ICPs at health facilities. In addition, not all health facilities report community-level data.[15] District supervisors review and validate the data in the DHIS2 and notify the ICP at the health post of any data entry errors. Malaria data reported by DSDOMs and ASCs include both fever and suspected malaria cases, number of patients tested, and confirmed malaria cases. In some areas, community-level data are not integrated into weekly surveillance data because it can be difficult for the health facility nurse to contact and receive data from ACs workers. Current efforts by the CSC to digitize community health data have equipped ASCs with mobile phones loaded with the DHIS2 application to ensure data flow up to the national DHIS2 database.[20] DHIS2 Capture has been selected as the digital tool to be scaled nationally for community-level data collection. Ongoing efforts are needed to support the digitalization of monthly case reporting through DHIS2 Capture, with additional resources needed to support hardware and software components required for facilitating data flow.

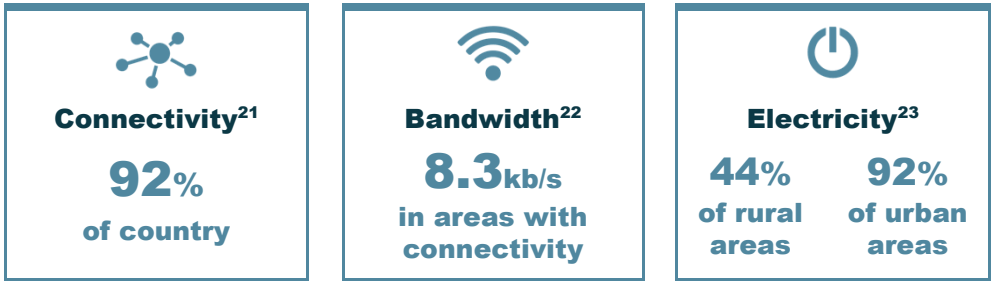
Although DHIS2 Capture feeds into the national SSE, other digital tools (e.g., mInfoSanté, DHIS2 Tracker) store data within their own servers, which can be accessed from key stakeholders at the facility, district, regional, and national levels. Paper-based reports are transmitted to the facility and district levels. Medicine and medical equipment stocks are managed by the National Pharmacy Supply Agency (Pharmacie Nationale D'Approvisionnement du Sénégal) and regional agencies through the Sage ERP (enterprise resource planning) X3 digital tool. Although there are plans to extend ERP X3 to the district level, it is not anticipated that it will be implemented at health posts.[15] Currently, no interoperability layer exists for community health tools, and only DHIS2 Capture (currently) and CommCare (in the past) have been configured to connect to the national SSE built on DHIS2.



Abbreviations: DHIS2, District Health Information Software 2; ODK, Open Data Kit; SSE, *surveillance, suivi et évaluation* (surveillance, monitoring, and evaluation system).

Digitally enabling infrastructure

Mobile network coverage is extensive in Senegal: over 90 percent of the population is covered by a network signal. The major network providers are Sonatel, Free (previously Tigo), and Expresso.[24] As of 2016, coverage of 2G/3G is 64 percent nationwide.[13] Despite this progress, a recent evaluation observed that only 5.9 percent of sampled health facilities had all necessary equipment for digital software use (computer, modem, electricity, and telephone).[25] Although servers are available for DHIS2, additional server capacity may be needed to house individual-level patient data. The national DH strategy describes rural and remote connectivity as fundamental to the success of DH and recommends continuing to strengthen the infrastructure.[2]



Digital health tools in use and functionality

A variety of digital tools have been used at the community level to communicate with clients, conduct health surveillance, and support case management. Those tools include DHIS2 Capture, DHIS2 Tracker, mInfoSanté, Open Data Kit Collect, and CommCare (see Appendix D for a more comprehensive list of tools and their geographic scale, funders, and implementers). Direct entry of activity reports by ASCs/matrones into DHIS2 is being piloted through the DHIS2 Capture application. DHIS2 Tracker is used by PATH's Malaria Control and Elimination Partnership in Africa project to conduct case investigation in 36 districts in pre-elimination regions. Users of DHIS2 Tracker include ASCs/DSDOMs who engage in reactive case response. Dimagi led a pilot of CommCare for malaria surveillance across 24 sites in 2016, but the pilot was discontinued due to the high annual costs. The US Peace Corps also led a pilot of digital PECADOM+ using CommCare in Kédougou Region to manage cases of febrile illness / malaria among all age groups and diarrhea or acute respiratory illness among children under 5 years old.[26] CVACs used mInfoSanté, an SMS RapidPro-based tool, to notify health posts of zoonotic disease alerts, as well as to coordinate communication on resources and service delivery. The platform can function in areas with low Internet coverage and with users who have low digital literacy.[15] Of these tools, the PNLP and the CSC are currently exploring the scale-up of DHIS2 Capture for health huts and DSDOMs; however, key gaps exist in procurement of mobile phones or tablets, reliable power sources, training, maintenance, customization, and scaling.

USE CASE(S)	DHIS2 Capture	DHIS2 Tracker	CommCare	mInfoSanté	ODK Collect
Providing malaria community case management	■	■	▪	□	▪
Tracking malaria proactive and reactive case detection	■	■	▪	□	▪
Tracking malaria screening with referral	■	■	▪	□	▪
Transmitting messages to community on malaria	▪	■	▪	▪	▪
Training health workers	▪	□	▪	▪	▪
Tracking routine LLIN distribution during ANC or EPI visits	▪	▪	▪	▪	▪

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

CASE MANAGEMENT FUNCTIONALITIES	DHIS2 Capture	DHIS2 Tracker	CommCare	mInfoSanté	ODK Collect
Aggregate case reporting and analytics Tool collects aggregate case data and has data analytic functions in tool or online	■	■	■	■	■
Individual case entry and analytics (*important in low-burden or elimination settings*) Tool collects individual case data and has data analytic functions in tool or online	■	■	■	■	■
Case geolocation (*important in low-burden or elimination settings*) Tool allows collection or use of geospatial data for individual cases	■	■	■	■	■
Interoperability with HMIS Tool sends information to the official national health information system	■	■	■	■	■
Off-line capability Tool functions, at least partially, off-line	■	■	■	■	■

MANAGEMENT & SUPERVISION FUNCTIONALITIES	DHIS2 Capture	DHIS2 Tracker	CommCare	mInfoSanté	ODK Collect
CHW identification Tool uniquely identifies CHWs	■	■	■	■	■
CHW catchment location Tool identifies CHW associated position in org unit hierarchy/link to health facility/system	■	■	■	■	■
CHW performance analytics Tool has analytic functions (data validation, graphs, charts) that support data quality, quality of care, or other performance issues	■	■	■	□	■
Communication 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: ANC, antenatal care; CHWs, community health workers; DHIS2, District Health Information Software 2; EPI, Expanded Program on Immunization; HMIS, Health Management Information System; LLIN, long-lasting insecticidal nets; ODK, Open Data Kit.

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 with timeline**

APPENDIX G ▶ **Malaria Case Incidence by District, 2020**

Digital Square is a PATH-led initiative funded and designed by the United States Agency for International Development (USAID), the Bill & Melinda Gates Foundation, and a consortium of other donors. This country brief was made possible by the generous support of the American people through USAID. The contents are the responsibility of PATH and do not necessarily reflect the views of USAID or the United States Government.

For more information: digitalsquare@path.org

APPENDIX A

References

1. Personal communication with Cellule Santé Communautaire (January 18, 2021).
2. Ministere de la Santé et de l'Action Sociale. *Plan Strategique Sante Digitale 2018–2023*. Dakar: Government of Senegal; 2018. https://sante.sec.gouv.sn/sites/default/files/Plan%20Strat%C3%A9gique%20Sant%C3%A9%20Digitale%202018%20-%202023.pdf.
3. Herrick T, Gannon S, Gilbert S. How digital health maturity can inform global goods design [blog post]. *Stories from Digital Square Digital Square and Our Partners*. December 9, 2019. https://digitalsquare.org/blog/2019/12/6/how-digital-health-maturity-can-inform-global-goods-design..
4. Ministère de la Santé et Action Sociale. *Bulletin Epidemiologique Annuel 2020 du Paludisme au Senegal.* Dakar: Government of Senegal; 2020.
5. Personal communication with the Programme National de Lutte contre le Paludisme (January 18, 2021).
6. Gaye S, Kibler J, Ndiaye JL, et al. Proactive community case management in Senegal 2014–2016: a case study in maximizing the impact of community case management of malaria. *Malaria Journal*. 2020;19(1):166. https://doi.org/10.1186/s12936-020-03238-0.
7. US President's Malaria Initiative. *Malaria Operational Plan FY 2020: Senegal*. Washington, DC / Atlanta, GA: US Agency for International Development / US Centers for Disease Control and Prevention; 2020. https://www.pmi.gov/docs/default-source/default-document-library/malaria-operational-plans/fy20/fy-2020-senegal-malaria-operational-plan.pdf?sfvrsn=6.
8. US President's Malaria Initiative. Community Health Inventory, unpublished data. 2018.
9. Devlin K, Farnham Egan K, Pandit-Rajani T. *Community Health Systems Catalog Country Profile: Senegal*. Arlington, VA: Advancing Partners & Communities; 2016. https://www.advancingpartners.org/sites/default/files/catalog/profiles/senegal_chs_catalog_profile_0_0.pdf.
10. MEASURE Evaluation. *La surveillance à temps réel au niveau communautaire: Un SMS pour identifier de façon précoce*. Chapel Hill, NC: MEASURE Evaluation; 2019. https://www.measureevaluation.org/resources/publications/fs-19-377.
11. Ministere de la Sante et Action Sociale. *Guide du formateur sur la surveillance épidémiologique communautaire intégrée*. Dakar: Government of Senegal; 2018. http://www.pnlp.sn/wp-content/uploads/2018/02/Guide-du-Formateur-surveillance-.-com-V2.pdf
12. Ministere de la Sante et Action Sociale. *Plan National de Développement Sanitaire et Social (PNDSS) 2019–2028*. Dakar: Government of Senegal; 2019. https://sante.sec.gouv.sn/sites/default/files/1%20MSAS%20PNDSS%202019%202028%20Version%20Finale.pdf.
13. Ministère des Postes et Télécommunications. *Stratégie: Sénégal Numérique 2016–2025*. Dakar: Government of Senegal; 2016. https://www.sec.gouv.sn/sites/default/files/Strat%C3%A9gie%20S%C3%A9n%C3%A9gal%20Num%C3%A9rique%202016-2025.pdf
14. Ministère de la Santé et Action Sociale. *Arrêté fixant les regles d'organisation et de fonctionnement de la Cellule de la Carte Sanitaire et Sociale, de la Santé Digitale et de l'Observatoire de la Santé (CSSDOS) du Ministère de la Santé et Action sociale (MSAS)*. Dakar: Government of Senegal; 2017. http://www.sante.gouv.sn/sites/default/files/arrete_cssdos.pdf.
15. Novel-T. *PATH Rapid Technical Assessment Senegal COUS/PNLP Assessment Report*. Switzerland: Novel-T; 2021.
16. Programme National Lutte Contre le Paludisme. *Plan Stratégique National de Lutte Contre le Paludisme au Sénégal 2021–2025*. Dakar: Government of Senegal; 2016. http://www.pnlp.sn/wp-content/uploads/2016/08/PNLP_PSN_VFF_03-02-2016.pdf.
17. Commonwealth Telecommunications Organisation. *Senegalese National Cybersecurity Strategy (SNC2022)*. Dakar: Government of Senegal; 2017. https://www.itu.int/en/ITU-D/Cybersecurity/Documents/National_Strategies_Repository/SNC2022-Senegal-NCS-Jan-2018_eng.pdf.
18. World Bank. *Information and Communications for Development 2018: Data-Driven Development*. Washington, DC: World Bank; 2019. https://openknowledge.worldbank.org/handle/10986/30437.
19. Nyakanini G, Sayinzoga M, Gates N, Almqvist E, Erkan K. *Unlocking the Digital Economy in Africa: Benchmarking the Digital Transformation Journey*. Washington, DC / Kigali, Rwanda: Digital Impact Alliance / Smart Africa; 2020. https://digitalimpactalliance.org/wp-content/uploads/2020/10/SmartAfrica-DIAL_DigitalEconomyInAfrica2020-v7_ENG.pdf.

20. Cellule de la Carte Sanitaire et Sociale, de la Santé Digitale et de l'Observatoire de la Santé (CSSDOS). *Programme De Digitalisation Du Secteur de la Sante* (version resumee). Dakar: Government of Senegal; 2020. https://sante.sec.gouv.sn/sites/default/files/Programme%20de%20Digitalisation%20du%20Secteur%20de%20la%20Sant%C3%A9%20Version%20Courte_1_A%20.pdf.
21. Baller S, Dutta S, Lanvin B, eds. *The Global Information Technology Report 2016: Innovating in the Digital Economy*. Geneva: World Economic Forum; 2016. https://www.wsj.com/public/resources/documents/GITR2016.pdf.
22. World Economic Forum website. Global Information Technology Report 2016: Networked Readiness Index: 3.03 international Internet bandwidth page. http://reports.weforum.org/global-information-technology-report-2016/networked-readiness-index/?doing_wp_cron=1604588326.4775559902191162109375#indicatorId=INTERNETBANDWIDTHPERUSER. Accessed March 31, 2021.
23. The World Bank website. DataBank: World Development Indicators: Senegal: Access to electricity, rural / access to electricity, urban: 2018 page. https://databank.worldbank.org/source/world-development-indicators#. Accessed March 31, 2021.
24. World Bank Group. *Digital Economy for Africa: Country Diagnostic of Senegal*. Washington, DC: World Bank; 2019. http://documents1.worldbank.org/curated/en/814111559645179494/pdf/Country-Diagnostic-of-Senegal.pdf.
25. MEASURE Evaluation. *Rapport d'évaluation du système de surveillance, suivi, évaluation du paludisme au Sénégal: Equipe d' évaluation*. Chapel Hill, NC: MEASURE Evaluation; 2020. https://senegal-cocreation.com/wp-content/uploads/2021/02/Rapport_Evaluation_SSE_Senegal_Revised_4.29.2020_Final.pdf.
26. Severe Malaria Observatory website. Senegal community case management page. https://www.severemalaria.org/senegal-community-case-management. Accessed May 20, 2021.

APPENDIX B

Abbreviations

ACS	Acteur Communautaire de Soins (community care actor)
ACPP	Agent Communautaire de santé Promotion et Prévention (community promotion and prevention worker)
ADIE	Agence de l'Informatique de l'État (State Information Technology Agency)
ANC	Antenatal Care
ASC	Agent de Santé Communautaire (community health worker)
CHW	Community Health Worker
CORP	Community-Owned Resource Person
CSC	Cellule de Santé Communautaire (Community Health Unit)
CSSDOS	Cellule de la Carte Sanitaire et Sociale, de la Santé Digitale et de l'Observatoire de la Santé (Health and Social Map, Digital Health and Health Observatory Unit)
CVAC	Comité de Veille et d'Alerte Communautaire (Community Watch and Alert Committee)
DH	Digital Health
DHIS2	District Health Information Software 2
DSDOM	Dispensateur de Soins à Domicile (home-based care providers)
DSISS	Division du Système d'Information Sanitaire et Sociale (Health and Information System Division)
DS	District Sanitaire
EA	Enterprise Architecture
EPI	Expanded Program on Immunization
HIS	Health Information System
HMIS	Health Management Information System
ICP	Infirmier Chef de Poste (post chief nurse)
ICT	Information and Communication Technology
iHRIS	integrated Human Resources Information System

IRS	Indoor Residual Spraying
IT	Information Technology
LLIN	Long-Lasting Insecticidal Net
LMIS	Logistics Management Information System
MACEPA	Malaria Control and Elimination Partnership in Africa
MSAS	Ministère de la Santé et de l'Action Sociale (Ministry of Health and Social Action)
NGO	Nongovernmental Organization
NORAD	Norwegian Agency for Development Cooperation
ODK	Open Data Kit
PECADOM	prise en charge à domicile (home care)
PNLP	Programme National de Lutte contre le Paludisme (National Malaria Control Program)
SSE	Surveillance, Suivi et Evaluation (surveillance, monitoring and evaluation system)
TWG	Technical Working Group
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

Contributors

Informant Name	Organization or Role
Maimouna Ba	DSDOM
Moustapha Cisse	PATH
Hamidou Diallo	DS Dagana
Maimouna Diallo	DSDOM
Penda Diatta	*Relais communautaire* (community relay)
Gnagna Dieng	PATH/MACEPA
Maimouna Dieye	ASC
Yakou Dieye	PATH
Fatou Diop	ASC
Moustapha Diop	DS Kaffrine
Amadou Fall	PATH
Cheikh Tidiane Gaye	PATH/MACEPA
Evrad Kabou	DS St Louis
Elhadj Malick Niang	DS Koungheul
Serigne Amdy Thiam	DS Kaffrine
Aida Diagase Thiaw	ASC
Aissata Sy	ASC

Abbreviations: ASC, agent de santé communautaire; DS, district sanitaire; DSDOM, dispensateur de soins à domicile; MACEPA, Malaria Control and Elimination Partnership in Africa

APPENDIX D

Community digital health tools*

Name of Tool	Type of Digital Health Intervention†	Implementer (Funder)	Scale	Malaria Use Case
DHIS2 Tracker	**2.1** Client identification and registration **2.2** Client health records **2.5** Health care provider communication **4.1** Data collection, management, and use **4.2** Data coding **4.4** Data exchange and interoperability	PATH/MACEPA (Bill & Melinda Gates Foundation)	36 districts (+500 CHW users)	Malaria case documentation Malaria reactive case detection and management Malaria screening with referral Messaging to community on malaria Reactive IRS Campaign IRS Tracking of routine LLIN distribution
CommCare	**2.1** Client identification and registration **2.2** Client health records **2.3** Health care provider decision support **2.5** Health care provider communication **2.6** Referral coordination **2.7** Scheduling and activity planning for health care providers **2.8** Health care provider training **4.1** Data collection, management, and use **4.2** Data coding **4.4** Data exchange and interoperability	Dimagi (PNLP, US President's Malaria Initiative)	N/A – no longer active	Malaria case management Malaria active or reactive case detection Malaria screening with referral Messaging to community on malaria Training of health workers Tracking of routine LLIN distribution
CommCare – Saving Lives at Birth	**1.1** Targeted client communication **1.2** Untargeted client communication **1.3** Client-to-client communication **1.5** Citizen-based reporting **3.1** Human resource management **3.3** Public health event notification **4.1** Data collection, management, and use	Africare, Dimagi (Grand Challenges)	Ziguinchor, Sédhiou, Kaffrine , Kédougou , Tambacounda, Saint – Louis Regions (12 Health districts, 135 Health posts)	N/A

Name of Tool	Type of Digital Health Intervention†	Implementer (Funder)	Scale	Malaria Use Case
DHIS2 (Web and Capture)	**2.1** Client identification and registration **2.2** Client health records **2.5** Health care provider communication **3.2** Supply chain management **3.7** Facility management **4.1** Data collection, management, and use **4.3** Location mapping **4.4** Data exchange and interoperability	Direction de la Planification, de la Recherche et des Statistiques, DSISS, Direction des Laboratoires, PATH/MACEPA (NORAD)	National	Malaria case management Malaria active case detection Malaria screening with referral
DHIS Capture (mobile version)	**2.2** Client health records **3.2** Supply chain management **3.4** Civil Registration and Vital Statistics **4.1** Data collection, management, and use	Save the Children (DSISS, Save the Children, University of Oslo)	Kaffrine Region	Malaria case management Malaria active or reactive case detection Malaria screening with referral
mInfoSanté	**1.1** Targeted client communication **1.2** Untargeted client communication **1.5** Citizen-based reporting **1.6** On-demand information services to clients **2.3** Health care provider decision support **2.6** Referral coordination **2.9** Prescription and medication management **3.3** Public health event notification **4.1** Data collection, management, and use **4.4** Data exchange and interoperability	Centre des Opérations d'Urgence Sanitaire (Health Emergency Operations Center), MEASURE Evaluation PATH, UNICEF	Saint-Louis and Tambacounda Regions	N/A
Open Data Kit	**2.1** Client identification and registration **4.1** Data collection, management, and use	PATH/MACEPA	N/A – no longer active, but previously in two regions in North	Malaria active or reactive case detection
Open Data Kit	**2.1** Client identification and registration **4.1** Data collection, management, and use	PNLP (PMI)	Tambacounda Region (60 villages)	Malaria active or reactive case detection Tracking of routine LLIN distribution
Pharmastock	**2.9** Prescription and medication management **3.2** Supply chain management **4.1** Data collection, management, and use	IntraHealth (USAID)	National	Tracking of routine LLIN distribution

Name of Tool	Type of Digital Health Intervention†	Implementer (Funder)	Scale	Malaria Use Case
R_Case	**1.1** Targeted client communication **1.2** Untargeted client communication **2.1** Client identification and registration **2.3** Health care provider decision support **2.4** Telemedicine **2.7** Scheduling and activity planning for health care providers **2.9** Prescription and medication management **3.4** Civil Registration and Vital Statistics **4.1** Data collection, management, and use **4.4** Data exchange and interoperability	IntraHealth (USAID)	National	Malaria case management Malaria active or reactive case detection Malaria screening with referral Tracking of routine LLIN distribution

Abbreviations: DHIS2, District Health Information Software 2; DSISS, Division du Système d'Information Sanitaire et Sociale (Health and Information System Division); IRS, indoor residual spraying; LLIN, long-lasting insecticidal net; MACEPA, Malaria Control and Elimination Partnership in Africa; MSAS, Ministère de la Santé et Action Sociale (Ministry of Health and Social Action); NGO, nongovernmental organization; NORAD, Norwegian Agency for Development Cooperation; PNLP, Programme National de Lutte contre le Paludisme (National Malaria Control Program); UNICEF, United Nations Children's Fund; USAID, United States Agency for International Development.

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

†See: World Health Organization (WHO). *Classification of Digital Health Interventions v1.0*. Geneva: WHO; 2018.

APPENDIX E

Next-generation tool functionalities for malaria case management

CASE MANAGEMENT FUNCTIONALITIES	DHIS2 Capture	DHIS2 Tracker	CommCare	mInfoSanté	ODK Collect
Notifications Tool sends and receives notifications	□	■	■	■	■
Stock reporting & analytics Tool collects stock data and has analytic functions to support stock and logistics data analysis and decision-making	■	■	■	□	■
Interoperability with other national health systems Tool sends information to other national systems (iHRIS, LMIS, etc.)	■	■	■	■	■
Referral coordination Tool allows CHW to notify local health facility of referrals and track them	■	■	■	■	■
Scheduling & work planning Tool allows CHW to plan and schedule key activities in the community	■	□	■	□	□

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

Abbreviations: DHIS2, District Health Information Software 2; iHRIS, integrated human resources information system; LMIS, Logistics Management Information System; ODK, Open Data Kit.

MANAGEMENT & SUPERVISION FUNCTIONALITIES	DHIS2 Capture	DHIS2 Tracker	CommCare	mInfoSanté	ODK Collect
Decision support Tool provides algorithms or checklists to guide CHW service provision	■	■	■	□	■
Training materials & resources Tool provides access to training materials, policies, or other useful reference documents	□	■	■	■	■

CHW geolocation Tool allows collection or use of CHW geolocation data for monitoring and planning distribution	■	■	■	□	■
Supervision Tool can be used by supervisors to assess CHW skills and capacity	■	■	■	■	■

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

Abbreviations: DHIS2, District Health Information Software 2; iHRIS, integrated human resources information system; LMIS, Logistics Management Information System; ODK, Open Data Kit.

APPENDIX F

Extended recommendations with timeline

PEOPLE

CHWs and decision-makers

Perform a deeper assessment on CHW needs

Responsible party: implementing partners with input from PNLP, PMI, CHWs, and other stakeholders

Short-term: An in-depth assessment is needed to better ascertain the needs, workforce capacity, and ability of CHWs to provide malaria case management and care. This assessment can be done rapidly to better profile end-user needs and better assess current workloads, technical capacity, and digital literacy. This assessment also could be expanded to understand existing workforce capacity within the regional and district levels for supervision of CHWs and to support DH programming and information technology (IT) implementation.

Develop a standardized DH training module for ASC/DSDOM/matrones

Responsible party: MSAS PNLP

Short-term: To strengthen the sustainability and increase the scale of community DH, the technical working group, or TWG (see recommendation in the governance section) should develop a standard DH training module for integration into the training curricula for ASC, DSDOM, and matrone. Regional- and district-level health management team participation in a "training of trainers" model should be considered to strengthen adoption and sustainability. Support should be provided to the TWG to develop, deploy, and evaluate the DH training module for DHIS2 Capture. The TWG should lead the development and deployment of a formal DH training package, incorporating the results of the evaluation of the DHIS2 Capture experience. A refresher training plan for new functionality, in line with the coordination work plan (see recommendation in the governance section) should be developed in parallel.

Strengthen DH technical support at the regional and district levels

Responsible party: MSAS

Short-term: A strong technical support structure is needed for reliable implementation of digital tools at scale. Therefore, there is a need to identify and train CHW supervisors who can provide basic technical and software support directly to ASCs/DSDOMs/matrones. In addition, it will be necessary to build the skills of regional- and district-level facility and center staff through refresher training and trainings on more targeted issues (e.g., device replacement). The hospital system should also be involved in supporting maintenance plans and repairing devices.

Long-term: A work plan is needed to establish a help desk to streamline technical requests from subnational health staff and to create mechanisms for consulting with partners to receive advance technical support and share lessons learned.

Develop a plan for improving malaria data quality/use with the PNLP and Cellule de Santé Communautaire (CSC), or "Community Health Unit," for the peripheral levels of the health system

Responsible parties: Cellule de la Carte Sanitaire et Sociale, de la Santé Digitale et de l'Observatoire de la Santé (CSSDOS), or "Health and Social Map, Digital Health and Health Observatory Unit"; and Division du Système d'Information Sanitaire et Sociale (DSISS), or "Health and Information System Division."

Short-term: Filling the gaps in data-driven decision-making at the peripheral levels of the health system would strengthen the quality of care provided. For example, positions with access to the DHIS2—such as the *infirmier chef de poste* (ICP), or "post chief nurse," and *acteur communautaire de soins* (ACs), or "community care actor"—need support for configuration and access to the dashboards, indicators, and other decision-support features within the platform. For CHWs that continue to report using paper-based tools, development of a system with key performance indicators to analyze and provide feedback to CHWs would be helpful. In addition to these tools, the plan should also include CHW participation in district-level data quality audits, trainings on data use and quality, performance incentives, and feedback mechanisms for ICPs to provide CHW with clinical care support.

Long-term: In addition, feedback evaluation procedures should be created that will ensure refresher training is focused on areas of higher malaria incidence or where training is deemed necessary. This could include refresher training on routine data entry, epidemic reporting and management, and stockpile management.

GOVERNANCE

Strategies and policies

Strengthen oversight/governance functions of the CSSDOS

Responsible party: MSAS

Short-term: An assessment is needed of the barriers to and potential solutions for CSSDOS oversight of DH coordination for CHWs. Following the assessment, the following should occur: (1) convene a meeting of partners to review and consolidate the role of the CSSDOS in overseeing the implementation of DH tools, as well as review the roles/responsibilities of partners vis-à-vis the CSSDOS; (2) create an alignment between the PNLP, CSC, and CSSDOS on digital tool implementation strategies in Senegal, including common terms of reference and harmonized work plans; (3) develop an action plan to ensure adequate financial autonomy, visibility, and coordination for the CSSDOS, which would be revised regularly as digital technologies evolve and progress.

Develop a TWG and coordination work plan to guide digitalization at the community level

Responsible party: MSAS (CSDDOS)

Long-term: Led by the CSSDOS—in consultation with the PNLP, CSC, DSISS, the MSAS IT Unit, and other implementing partners—the parameters of the TWG would include membership, affiliations, roles, responsibilities, requirements, a timeline, and short- and long-term desired outcomes. The TWG should subsequently develop a comprehensive work plan which would support current digitization efforts and data-use initiatives, as well as guidance for digital community health tools to adhere to the national architecture. A vision of long-term goals should be developed to strengthen procedures for responding to donor data requests and strategies to engage the private sector and mobilize domestic resources for co-funding.

Support DH enterprise architecture (EA) and policy documents

Responsible parties: CSSDOS; l'Agence de l'Informatique de l'État (ADIE), or State Information Technology Agency; DSISS; and partners

Short-term: Consistent with the DH strategy, a review process should be facilitated with ADIE to create standards for the health sector and develop a national DH EA, including a framework to regulate tool design, implementation, and interoperability.

Long-term: It is necessary to create an advocacy plan with ADIE and the CSSDOS that emphasizes the need to develop an EA for standards and interoperability, as well as advocate for the next level of DH policies covering health information exchange, mobile device management, and the workforce.

SYSTEMS

Processes and digital tools

Support ongoing efforts to digitalize monthly case reporting for ACs cadres through the DHIS2 Capture application

Responsible party: MSAS

Short-term: In coordination with the PNLP, CSC, CSSDOS, the MSAS IT Unit, and the Global Fund, the MSAS should develop a costed plan to fill the current gaps in scaling DHIS2 Capture among CHWs. This costed plan would include purchasing cell phones or tablets and solar chargers; providing training, maintenance, and post-training supervision; configuring ACs reporting forms in the DHIS2 Capture; inserting a community structure under the health post in the DHIS2; and developing large-scale implementation work plans. It is also important to identify opportunities for co-investment from the government and other partners. For this project, it is also important to consider how the provision of devices to ACs workers may affect the motivation of other promotion and prevention CHW.

Identify potential digital tools for ASC/DSDOM/matrone supervision and commodities management

Responsible parties: PNLP, CSC, CSSDOS, and DSISS

Short-term: A meeting should be held to evaluate the configuration of supervisory functionality (i.e., including the supervisory scorecard table, identifying unique ASCs, and performing performance analysis), as well as commodities management functionality (i.e., tracking weekly input flow, taking orders from peripheral levels, and sending real-time notifications to the ACs workers to alert them of anticipated or ongoing stockouts) of potential digital tools.

Long-term: Consistent with PNLP and CSC priorities for strengthening oversight and commodities management, it is necessary to create a plan with the CSSDOS and DSISS to add additional tools as resources allow, noting that all digitized processes must be interoperable with the *surveillance, suivi et évaluation* (SSE) system (surveillance, monitoring, and evaluation system) / DHIS2.

Develop an interoperability layer to connect all current and future tools and subsystems

Responsible parties: CSSDOS and DSISS

Long-term: Meetings with the DSISS, CSSDOS, and partners should be organized to discuss ways to modify existing tools (e.g., mInfoSanté, DHIS2 Tracker) to merge the data repository portions with the DHIS2 platform. It is also necessary to create a plan with the CSSDOS and DSISS to implement an interoperability layer so that future subsystems identified in the health digitization agenda (e.g., shared patient records, integrated inventory management system) can be made accessible to ACs workers with mobile devices, as well as implement a pilot for testing the interoperability of shared patient records with the national DHIS2, resulting in automatic extraction of health indicators to the DHIS2.

Work with the MSAS to nationalize a malaria case management tool that is interoperable with DHIS2

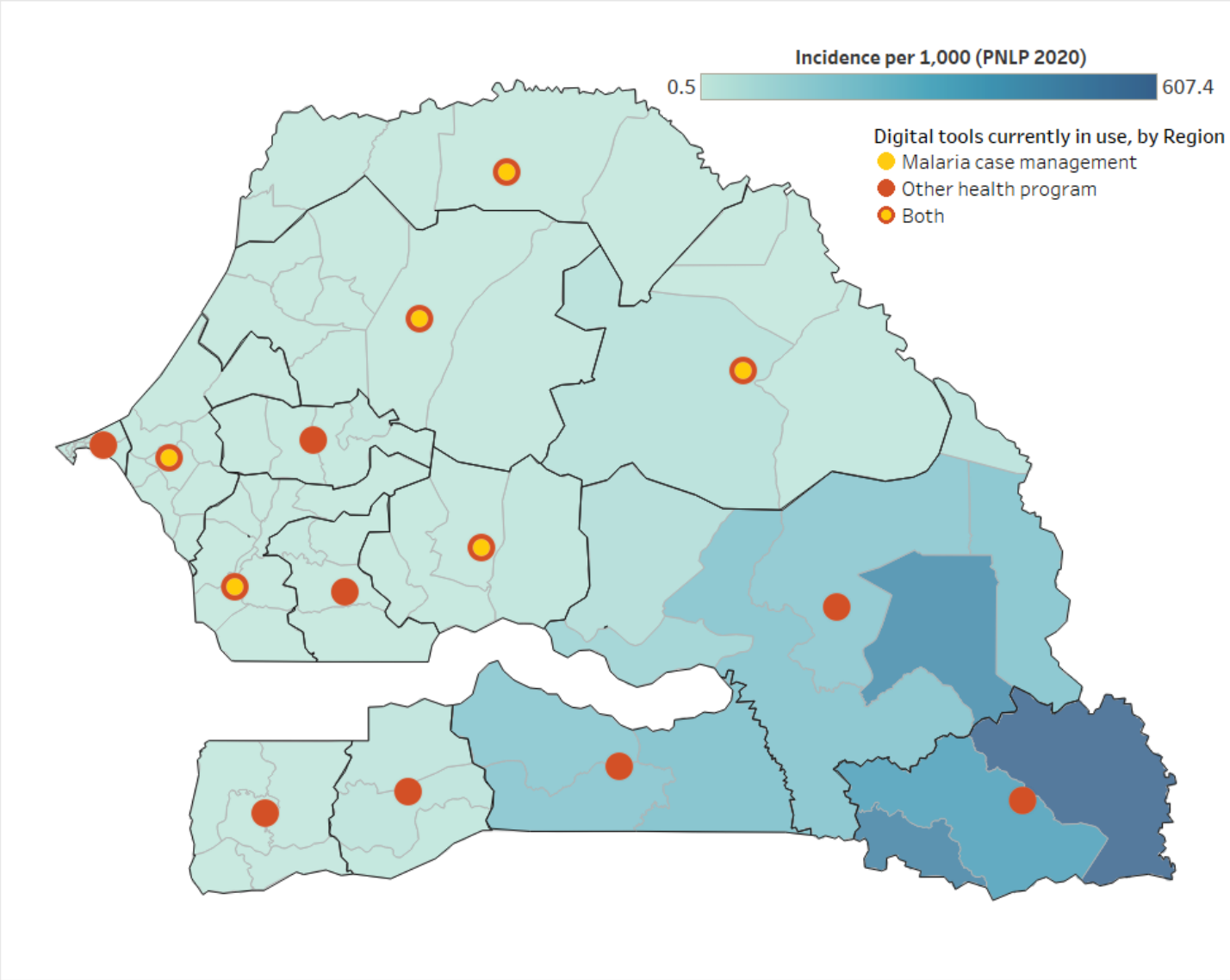
Responsible party: MSAS

Short-term: An assessment should be made on the ethical implications of individual data collection and measures developed to ensure that CHWs comply with ethical standards (e.g., training in data ethics principles).

Long-term: As the incidence of malaria in Senegal declines and many regions begin to implement pre-elimination activities, it will be necessary to move from collecting data on aggregate cases to collecting individual cases and managing care. The PNLP and DSISS need to decide whether the DHIS2 Tracker pilot meets the needs of the national individual reporting system for malaria case investigation and case management or whether another tool is needed. They should develop a plan to create interoperability with the DHIS2, including the creation of server capacity, and expand individual data collection to other future pre-elimination areas.

APPENDIX G

Malaria Case Incidence by District, 2020



Source: Programme National de Lutte contre le Paludisme (National Malaria Control Program). *Bulletin Epidemiologique Annuel 2020 du Paludisme au Senegal*. Dakar: Government of Senegal; forthcoming.