June 2019–October 2023

PMI Measure Malaria End-of-Project Report

PMI | U.S. PRESIDENT'S MALARIA INITIATIVE
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PMI Measure Malaria

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PMI Measure Malaria

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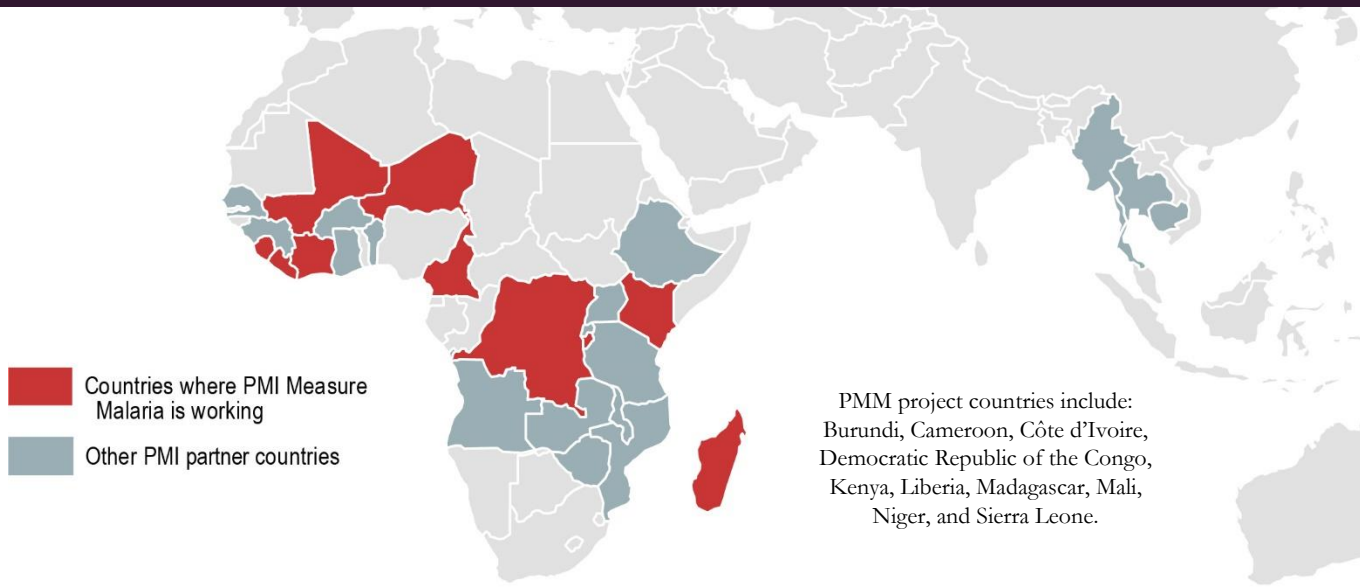
Contents

Abbreviations

ACT	artemisinin-based combination therapy
AFENET	African Field Epidemiology Network
AL	Artemeter Lumefantrine
ASTMH	American Society of Tropical Medicine and Hygiene
CDC	U.S. Centers for Disease Control and Prevention
CHAI	Clinton Health Access Initiative
CHISU	Country Health Information Systems and Data Use
CHT	County Health Team
COE	Committee of Experts
CRSN	Centre de Recherche en Santé de Nouna
DEPSI	Direction des Etudes et de la Planification et du Système d'Information
DEPV	Directorate of the Expanded Program on Immunization
DHIS2	District Health Information Software, version 2
DLMEP	Direction de la Lutte contre la Maladies, les Epidémies et les Pandémies
DNMP	Division of National Malaria Control Progamme
DPPI	Directorate of Policy, Planning and Information
DRC	Democratic Republic of the Congo
DSFa	Directorate of Family Health
DSNIS	Direction du Système National d'Information Sanitaire
DVSSER	Directorate of Health Surveillance and Epidemiological and Response Surveillance
EPR	Epidemic Preparedness and Response
FETP	Frontline Epidemiology Training Program
GIS	geographical information systems
GMP	WHO Global Malaria Programme
GTS	Global Technical Strategy
HIS	health information system

IDSR	Integrated Disease Surveillance and Response
IPTp	intermittent preventative treatment in pregnancy
ITN	insecticide-treated net
KHIS	Kenya Health Information System
KM	Knowledge Management
KMS	Kenya Malaria Strategy
LMIS	logistic management information system
M&E	monitoring and evaluation
MECAT	Monitoring and Evaluation Capacity Assessment Toolkit
MEL	monitoring, evaluation, and learning
MII	Malaria Information Index
MIS	Management Information System
MOH	Ministry of Health
MOPH	Ministry of Public Health
MRDQA	malaria routine data quality assessment
mRDT	malaria rapid diagnostic test
MWC	malaria wall chart
NMCP	National Malaria Control Program
PMI	U.S. President's Malaria Initiative
PMM	PMI Measure Malaria
RBM	Roll-Back Malaria
RBM SMERG	RBM Partnership to End Malaria, Surveillance, Monitoring, and Evaluation Reference Group
RHIS	routine health information system
SMC	seasonal malaria chemoprevention
SME	surveillance, monitoring, and evaluation
TWG	technical working group
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development



Executive Summary

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project was a five-year cooperative agreement funded by PMI and the United States Agency for International Development (USAID). PMM's objective was to ensure high-quality malaria data with strengthened analysis and use of these data for improved policies, programs, and service delivery—thus contributing to PMI's goal of reducing malaria morbidity and mortality in priority countries. PMM assesses its contributions to PMI's goals, with partner countries, through the following results:

Result 1 Strengthened country-level capacities to collect, analyze, and use routine data

Result 2 Improved country-level capacities to manage health information systems

Result 3 Enhanced methods, tools, and approaches to address health information challenges

Outcome indicators:

- **Improved HIS data quality**
- **Improved data use practices**
- **Malaria information used**

From June 2019 through October 2023, PMM provided technical and financial support to ten countries: Burundi, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo (DRC), Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone. PMM's engagement with country partners yielded global and country-specific achievements in data collection, analysis, and use; health information system (HIS) management; and use of tools, methods, and approaches to address health information challenges and needs. This report captures achievements across all project years, as PMM made global and country-level contributions to strengthening health information systems and malaria surveillance, monitoring, and evaluation (SME).

PMM's support led to the following achievements in the three result areas:

Result 1: **Ten** project-supported countries demonstrated improvement in capacities for routine health data collection and/or analysis (Burundi, Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone). Technical achievements in this result area included:

- Supporting **nine** countries to hold data review meetings
- Supportive supervision visits to health facilities in **nine** countries
- Implementing malaria wall charts (MWCs) in Cameroon and Côte d'Ivoire to assist health facilities in collecting, analyzing, and using malaria data
- Facilitating country-specific training events on the use of Malaria Routine Data Quality Assessment (MRDQA), data collection and analysis, and malaria SME within **nine** countries
- Partnering with the African Field Epidemiology Network (AFENET) and Centre de Recherche en Santé de Nouna (CRSN) to facilitate **two** regional malaria SME trainings
- Managing online Anglophone and Francophone malaria SME training courses

Result 2: **Ten** project-supported countries demonstrated improvement in capacities for HIS management (Burundi, Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone). Technical achievements in this area included:

- Convening national technical working groups (TWGs) in **nine** countries and subnational TWGs in **three** countries
- Supporting partners in **five** countries to develop, review, and update key governance documents such as monitoring and evaluation (M&E) plans
- Supporting **ten** countries to enhance their District Health Information Software, version 2 (DHIS2) data collection, analysis, and/or use capabilities
- Implementing, scaling up, and evaluating the use of mobile-friendly dashboard and scorecard applications in Côte d'Ivoire and Madagascar to facilitate subnational data analysis and use

Result 3: **Ten** project-supported countries applied a method, tool, or approach to address a health information challenge (Burundi, Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone). Technical achievements in this area included:

- Conducting SME capacity assessments in **three** countries employing the Monitoring and Evaluation Capacity Assessment Toolkit (MECAT) and using the findings to develop capacity-strengthening plans
- Implementing the Malaria Surveillance Assessment toolkit in **two** countries to better understand the status of the countries' malaria surveillance systems
- Supporting data quality assurance through implementing the MRDQA in **nine** countries
- Developing the Malaria Portal to share routine health information system (RHIS) profiles for **21** PMI-partner countries
- Sharing a protocol to help countries develop data dictionaries and piloting the guide in the DRC

PMM project achievements led to the following project impacts:

- **Six** project-supported countries demonstrated improvement in HIS data quality: Cameroon, Cote d'Ivoire, DRC, Kenya, Liberia, and Madagascar.
- **Eight** project-supported countries demonstrated improvement in data use practices: Burundi, Cameroon, Cote d'Ivoire, Kenya, Liberia, Madagascar, Mali, and Sierra Leone.
- **Nine** project-supported countries documented use of malaria information: Cameroon, Cote d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone.

Challenges

- COVID-19 restrictions prevented in-person activities, including meetings for data review and TWGs, field visits, and training.
- Inconsistent internet connections made it challenging for some health facilities to participate in virtual activities and affected consistent and timely data reporting and review.

Lessons Learned

- Subnational capacity strengthening activities such as mentorship and supportive supervision are cost-effective and efficient ways to strengthen malaria SME and stimulate data use.
- Collaboration between PMM, National Malaria Control Programs (NMCPs), and implementing partners through environments such as TWG meetings improved coordination, facilitated information and resource sharing, and helped avoid duplication of effort.
- NMCP ownership of tasks was crucial for successful implementation and will make countries more likely to continue activities after PMM support ends.

Introduction

PMI Measure Malaria (PMM) was a five-year cooperative agreement funded by the United States President's Malaria Initiative (PMI) and the United States Agency for International Development (USAID). PMM built off the legacy of its leader award, MEASURE Evaluation Phase IV, which ensured rigorous methods for monitoring and evaluation (M&E), developed tools in use around the world to improve data quality and data use, and defined the components of high-functioning health information systems (HIS) and effective means to improve them.

PMM's objective was to ensure high-quality malaria data with strengthened analysis and use of these data for improved policies, programs, and service delivery; ultimately, contributing to PMI's goal of reducing malaria morbidity and mortality in priority countries. The project worked to strengthen HIS and M&E practices of malaria programs,

thereby helping countries progress toward their malaria burden reduction and elimination goals by enhancing a country's ability to monitor progress and improve their programs. PMM's approach involved technical and thought leadership for HIS strengthening, and collaboration with global, national, and subnational organizations for the institutionalization of improved practices for data collection, analysis, and use.

PMM set to improve data quality and use by achieving the following results:

- Result 1: Strengthened country-level capacities to collect, analyze, and use routine health data
- Result 2: Strengthened country-level capacities to manage HIS
- Result 3: Enhanced methods, tools, and approaches applied to address health information challenges

PMI Measure Malaria worked with countries to enhance their health information systems for malaria surveillance. This included improving capacities in data management, analysis, and use. The project aimed to produce better data quality, a supportive HIS environment, and the application of tools for addressing health information gaps.

These efforts were expected to improve HIS performance for malaria surveillance, leading to better data quality and more effective use in program improvement and decision making.

To achieve these goals, PMM implemented strategies outlined in USAID-approved work plans, considering factors like malaria transmission intensity, specific country needs, coordination, capacity strengthening, knowledge management, and communication. Implementing these activities resulted in improved data availability and the capacity to use this data to enhance programs and policies; ultimately, contributing to reducing malaria morbidity and mortality.

RESULT 1: Strengthened Country-Level Capacities to Collect, Analyze, and Use Routine Data

10 countries improved routine data collection, analysis, and use

Routine data collection, analysis, and use refers to the set of activities in a country that generates health information and includes data sources or data management. Related technical components include improving data sources; collecting data; managing data; and analyzing, synthesizing, and interpreting data. PMM worked with country partners to strengthen data collection, analysis, and use of high-quality data by enhancing workforce skills and infrastructure for these tasks. Health data may be recorded and shared through paper-based or electronic systems at various levels of the healthcare system. Over time, country partners enhanced their skills in these areas, demonstrating strengthened capacity. Ten project-supported countries strengthened their capacity for data collection, analysis, and use: Burundi, Cameroon, Cote d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone.

Achievements

Data Review Meetings

Nine PMM-supported countries—Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Niger, Madagascar, Mali, and Sierra Leone—held data review meetings at the district, regional, county and sub-county, and national levels. During data review and discussion meetings, National Malaria Control Programs (NMCPs) and implementing partners reviewed data submitted by PMM-supported health districts and subcounties to identify data quality issues and find solutions to address those issues. Data review meetings helped improve data quality and use, facilitated information sharing, and helped countries to develop performance improvement plans based on needs identified during

9 countries held annual data review meetings

meetings. Improved data quality at the health facility level contributed to improved malaria service delivery.

From 2020 to 2023, **Sierra Leone's** NMCP partnered with PMM and other implementing partners to improve malaria data quality and usage in PMM-supported districts. The NMCP conducted quarterly data review and validation meetings following malaria routine data quality assessment (MRDQA) visits. These meetings identified data quality issues, provided guidance, and developed data quality improvement plans. PMM supported in organizing these meetings in Bo, Kionadagu, and Port Loko districts, involving 25-35 health facilities in each. The objectives were to verify data accuracy, assess malaria indicators, create action plans, and track improvements. The collaboration improved synergy among district personnel and enhanced data-driven decision making, benefiting malaria service delivery.

In **Cameroon**, PMM provided technical assistance to regional staff and district health data managers to hold monthly data review meetings at all 45 districts in the North Region and Far North Region. In 2022, Cameroon presented a poster at the American Society of Tropical Medicine and Hygiene (ASTMH) conference on changes in data quality resulting from data review meetings. An interrupted time-series analysis compared data consistency before and after the introduction of data review meetings in January 2019 and found that holding data review meetings at the district level was associated with an **83% reduction in mean data inconsistencies in the North Region and a 68% reduction in the Far North Region.**

PMM supported **Madagascar's** NMCP to organize 12 data review meetings at the national level to review data from DHIS2 for accuracy and concordance across data sources. These regular meetings, and subsequent implementation of action points, resulted in sustained high reporting rates. Following the meetings, monthly reporting completeness remained high—at 94-97%—throughout the project period and timeliness increased from 37% in 2019 to 92% in 2023.

Malaria Wall Charts

In 2019, the **Liberia** NMCP aimed to enhance data quality, tracking of key malaria indicators at health facilities, and prompt data review for decision making. MEASURE Evaluation and the Maternal and Child Survival Program/Expansion of Malaria Services project introduced a printable malaria wall chart (MWC) template. During Year 2 of the PMM program, health facility staff provided feedback, leading to MWC updates, including clinically diagnosed malaria cases treated with artemisinin-based combination therapy (ACT), severe malaria cases, institutional deliveries, and intermittent preventive treatment in pregnancy (IPTp) coverage. Recognizing their value, county-level staff advocated for expanding MWCs from 320 to all 750 facilities, highlighting improved data management practices. Given the success of the MWCs in Liberia, PMM introduced them in **Cameroon** in 2022, where they were well-received and appreciated by health providers. These charts allowed for better monitoring of malaria control interventions and fostered data review for decision making, emphasizing the importance of data visualization tools in healthcare data management.

Field Epidemiology and Laboratory Training Program Trainings in Cameroon

In years 2 and 3, PMM supported the Direction de la Lutte contre la Maladies, les Epidémies et les Pandémies (DLMEP) to organize five cohorts of Field Epidemiology and Laboratory Training Program (FETP) field training in the Far North Region and three cohorts in the North Region. The FETP trainings aimed to improve best practices in malaria surveillance. Cohorts of 24 participants from the North Region and 24 participants from the Far North Region underwent a 12-week training, followed by a one-week onsite training and fieldwork. FETP training sessions and associated field activities helped trainees understand the importance of data quality and how to apply training content to improve their work. During fieldwork, trainees worked with health facilities and had the opportunity to follow up to ensure that recommendations they left during their training were implemented. Giving participants applied experience with data and emphasizing the importance of data quality at the health facility level helped to improve data quality at the local level. The training had a graduation rate of approximately 94% (178/190 participants).

Strengthened Capacity for National Staff in Madagascar to Mentor District Staff on Data Analysis and Use

Madagascar's NMCP made significant achievements in improving SME practices at the subnational level. In 2020, the NMCP developed standardized coaching tools for data analysis and an interactive Excel spreadsheet for rapid data quality validation. Training was provided to central-level staff

on the use of DHIS2 and the World Health Organization (WHO) data quality review tool, with knowledge successfully transferred to district-level data managers responsible for reporting health facility-level data into the platform.

A coaching plan was established in collaboration with the Direction des Etudes et de la Planification et du Système d'Information (DEPSI), where central-level DHIS2 administrators oversaw regions and districts, ensuring data completeness and timeliness while troubleshooting challenges. This approach not only enhanced coaching and mentorship capacities at the central level but also strengthened ownership of DHIS2 among the NMCP and DEPSI.

These efforts resulted in increased trust and utilization of the integrated system by subnational staff, enabling more efficient data entry, analysis, and visualization of malaria data at the district level. These achievements serve as crucial steps toward improving SME practices and, ultimately, enhancing malaria control interventions in Madagascar.

Mentorship to Improve SME Capacity in Kenya

PMM initiated a malaria SME mentorship program in eight lake-endemic Kenyan counties. The project trained 215 county and subcounty staff from 63 subcounties in malaria epidemiology, surveillance, key indicators, data analysis, and mentorship skills. This program addressed capacity challenges arising from staff turnover and knowledge loss.

Mentors identified health facility needs and designed capacity-strengthening curricula. In Vihiga County, they improved data quality, reporting, HIS tool usage, and staffing. In two phases, mentors trained workers in data documentation and analysis, then held data quality improvement meetings. Completeness of malaria data in Vihiga County increased from 69% to 97%.

The program achieved 95% coverage of health facilities and conducted 2,760 mentorship visits across 1,252 health facilities from February 2021 to June 2023. It improved data quality assessments, identified best practices, and stimulated mentor commitment to continue activities and promote county ownership in the future.

East Africa Hub Webinars

In year 3, PMM used funds from the East Africa Regional Bureau to organize quarterly East Africa Hub Webinars on SME-related issues. The webinars helped improve country engagement and connection to the global community and covered topical issues that affected the countries, the implementing partners, and the funding agents.

Table 1 shows the number of attendees at each webinar. Recordings were presented at the closeout meeting in Nairobi and are available on PMM's website.

A mentor conducting MRDQA in Kisumu County, Kenya

Table 1. East Africa Hub Webinar attendance

Webinar Title	Date	Number of Attendees
Lessons Learned in Malaria Surveillance	December 2021	104
Using Digital Technology to Improve Quality and Use of Malaria Data	February 2022	154
Inpatient Morbidity and Mortality: What will it take for health systems to generate accurate information for severe malaria and malaria mortality?	December 2022	84
Reaching the Unreached: How do we identify hard-to-reach populations and measure success of interventions	January 2023	130

Table 2. Malaria SME online course completion rate by course

	2019	2020	2021	2022	2023
Anglophone course	7.7% (21)	36.6% (261)	27.6% (161)	37.8% (70)	40.0% (4)
Francophone course	11.5% (8)	43.5% (156)	48.3% (159)	43.1% (63)	100% (4)
Total	8.5%	38.9%	35.1%	40.1%	57.1%

Malaria SME Training Platform

PMM maintained the core-funded malaria SME online course originally created under MEASURE Evaluation and developed a new module on data analysis for routine malaria data that includes the use of DHIS2 and geographic information systems (GIS) and incorporates the WHO malaria module. The SME online platform registered a total of 3,227 users from 2019–2023. More than 50% of course participants were monitoring and evaluation (M&E) officers or people involved in the medical field such as health center staff and nurses. Other participants included researchers, students, and staff from non-governmental organizations (NGOs). Table 2 shows the completion rate for the Anglophone and Francophone SME course participants by year.

Collaboration with AFENET and CRSN

Using core funds, PMM collaborated with the University of Ghana School of Public Health's African Field Epidemiology Network (AFENET) to implement an Anglophone regional workshop and the Centre de Recherche en Santé de Nouna (CRSN) to implement a Francophone regional workshop. The SME courses were advertised to help increase attendance. In Year 1, PMM worked with AFENET and CRSN to develop a mentorship plan that was implemented beginning in Year 2.

Lessons Learned

Holding data review meetings at the district, regional, and national levels improved data quality and facilitated the development of performance improvement plans. This contributed to enhanced malaria service delivery. The success of data review meetings underscores the importance of regular data review for data quality improvement in healthcare systems.

PMM-sponsored trainings demonstrate that educating local health workers in data quality and analysis, followed by mentorship and supportive supervision, leads to improved data quality at the health facility level. Mentorship programs, such as the one implemented in Kenya, also improve data quality at the health facility level and ongoing mentorship helps sustain data quality improvements. The success of these activities highlights the value of building local capacity to ensure high-quality data.

The creation and maintenance of an online course on data analysis, integrated with DHIS2 and GIS, led to significant participation from healthcare professionals and other stakeholders—demonstrating the value of accessible and comprehensive training platforms in improving data analysis skills.

RESULT 2: Strengthened Country-Level Capacities to Manage HIS

Strong management and governance are essential to optimal HIS performance. PMM supported countries in enhancing their HIS management capacities and practices by developing management tools and resources, providing training and technical assistance, and leading efforts to improve the interoperability of digital health information and digital health data systems. A country is counted towards this result area when it demonstrates increased capacity in at least one technical component directly related to PMM support. Country-level capacities for the HIS management area increased with PMM support when skills

10 **countries improved HIS management**

are enhanced or practices are established or enhanced through PMM support. Ten PMM-supported countries demonstrated improvement in their capacities for HIS management: Burundi, Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone.

Achievements

Technical Working Groups

9 countries have functional TWGs

PMM supported NMCPs to convene national-level technical working group (TWG) meetings in nine project-supported countries, and subnational TWGs in three countries. TWG meetings improved coordination among stakeholders, including NMCPs, implementing partners, and funding agencies. The TWGs served as effective platforms for sharing knowledge, discussing SME and data system challenges, and defining efforts and strategies to address them.

A midterm malaria program review in **Burundi** revealed that the lack of a mechanism for coordination of SME partners was a challenge. In Year 2, PMM supported Burundi's NMCP to create a national-level malaria SME TWG to bring together the NMCP, Direction du Système National d'Information Sanitaire (DSNIS), USAID/Burundi, and other malaria partners. The NMCP and PMM developed terms of reference (TOR) establishing the objective of the TWG, the stakeholders involved, and meeting logistics. SME TWG meetings provided a forum for discussion and to make decisions regarding malaria research topics of interest to the NMCP and partners, as well as the definition and configuration of special event indicators in the DHIS2.

PMM supported **Cameroon's** regional SME TWG meetings in the North Region and Far North Region. These meetings aimed to strengthen the Regional Delegations for Public Health (RDPH) system and to support coordination of malaria activities at the national and regional levels. Cameroon holds quarterly regional meetings and semiannual national meetings.

PMM supported the **DRC's** NMCP to lead TWG meetings at the national and provincial levels. These meetings brought together technical malaria stakeholders, including PATH, Clinton Health Access Initiative (CHAI), Impact Malaria, USAID, Integrated Health Program, WHO, DSNIS, and the United Nations Children's Fund (UNICEF). The DRC used the TWG meetings to develop technical documents such as malaria data analysis and surveillance guidelines and partner coordination plans. These meetings improved coordination among technical and implementing partners which contributed to the improved coordination of malaria activities. TWGs also provided an opportunity for data use. For example, Lomami Province's M&E TWG used findings from the MRDQA implementation to observe data collection tool stockout and to advocate for printing and distribution of updated data collection and reporting tools.

In Year 3, PMM provided technical and logistic support to hold quarterly malaria TWG meetings in **Kenya's** eight PMI-supported lake-endemic counties. The TWGs in Kenya foster malaria stakeholder coordination and build capacity for malaria surveillance mentorship and conducting routine data quality audits. Topics of the TWG meetings included developing strategies to improve quality of routine malaria data, streamlining reporting of community-based malaria data, and improving completeness of malaria inpatient reporting. County TWG meetings led to increased instances of malaria data use. For example, the Busia County TWG identified gaps in the distribution of commodities across subcounties, with some subcounties running low on Artemeter Lumefantrine (AL) while others were overstocked. Additionally, it was discovered that some subcounties were overstocked with short expiry malaria rapid diagnostic tests (mRDTs). The TWG recommended immediate redistribution of the AL and mRDTs. As a result, health facilities were brought to optimal stock levels. Timely review of commodity data at the county level enabled appropriate resource allocation.

In **Mali**, PMM worked with the NMCP and implementing partners to reenergize malaria SME TWG meetings. PMM supported the NMCP to update the list of partners targeted for participation in the meetings, revise the terms of reference, organize the meetings, prepare PowerPoint presentations, and write notes. This support helped ensure that meetings were organized regularly. The NMCP organized eleven quarterly malaria SME TWG meetings between July 2020 and June 2023 to strengthen SME governance and, ultimately, enhance overall SME performance.

Sierra Leone's Directorate of Policy, Planning and Information (DPPI) organized national monthly

HMIS/M&E TWG meetings which were attended by PMM and the NMCP. PMM supported the NMCP to hold SME subgroup TWG meetings that brought together SME specialists from the NMCP, implementing partner organizations, and stakeholders to harmonize malaria SME efforts and discuss emerging malaria SME issues. TWG meetings in Sierra Leone helped improve coordination of malaria activities, which strengthened and ensured the synergistic implementation of activities at the national and subnational levels and helped prevent duplication of effort.

A monitoring and evaluation TWG meeting in DRC

Development, Review, and Update of Key Governance Documents

PMM supported country NMCPs to develop, review, and update key governance documents that aid in operationalizing essential processes and actionable steps for working toward national malaria control and elimination goals. The following achievements demonstrate the respective country NMCP's increased dedication toward and capacity to review and improve strategic documents based on evolving needs.

In **Côte d'Ivoire**, PMM and the NMCP integrated the 2021–2025 M&E plan into the 2021–2025 strategic plan. They finalized the Malaria National Strategic Plan in July 2020, then developed an operational plan specifying tasks and responsibilities for stakeholders at all health system levels. In Year 3, PMM supported the NMCP in conducting a dissemination workshop for the 2021–2025 malaria M&E plan, targeting regional malaria technical advisors, health district managers, and implementing partners. This marked the initial step in implementing the national malaria strategic and M&E plans at the local level, with regional technical advisors responsible for distributing these resources for use by health facility staff. The NMCP's efforts to define roles and responsibilities have enhanced adherence and implementation across the health system.

In the DRC, PMM collaborated with the NMCP to develop a leadership roadmap, assess challenges, and create a costed action plan in Year 3. The NMCP integrated these actions into its 2022 operational plan and progress is regularly reviewed in monthly meetings with the NMCP, PMM, and partners. The NMCP recently urged partners including CHAI, PMI, and WHO to support activities that align with its plans, thus showcasing improved leveraging of resources and planning. The NMCP plans to hold a performance review to secure future support, highlighting its commitment to enhancing leadership and management skills.

Mali's NMCP, in collaboration with PMM and WHO, conducted midterm and end-term performance reviews of the 2018–2022 national strategic plan. PMM provided technical input to the reviews and to the development of a consolidated review report. After the reviews, PMM made technical and financial contributions to the development of the revised 2018–2022 strategic plan and the 2023–2027 malaria strategic plan. PMM also supported Mali's NMCP to revise the existing malaria guidelines to better align with the 2016–2030 Global Technical Strategy (GTS) recommendations, as well as the results from the malaria transmission intensity stratification report.

In **Kenya**, PMM provided technical and logistical support to the DNMP to conduct a midterm review of the Kenya Malaria Strategy (KMS) 2019–2023. PMM provided technical support during validation of midterm review findings by external reviews from WHO and Roll Back Malaria, then incorporated feedback from reviewers and disseminated a revised report. Updates to the KMS helped optimize the strategy's final year of implementation.

PMM further supported development of strategic documents in Kenya by providing technical and logistic support to the DNMP to develop a malaria elimination implementation plan. In March 2021, PMM facilitated a workshop on malaria elimination for Ministry of Health national and county-level staff, as well as malaria elimination Committee of Experts (COE) members. The workshop covered processes, requirements, and priority activities for malaria elimination in Kenya.

PMM provided technical and financial assistance to **Sierra Leone's** NMCP to develop the National Malaria SME Plan

2021–2025, which was closely aligned with the National Malaria Strategic Plan. Data analysis for malaria stratification guided development of the strategic plan. PMM and the NMCP finalized the National Malaria Strategy in September 2020 and disseminated the plan to all relevant stakeholders.

Transition of Malaria Data into DHIS2 in Madagascar

In Year 2, the Madagascar NMCP committed to adopting DHIS2 as the central platform for malaria data, aiming to consolidate all malaria data types. PMM collaborated with the Madagascar Ministry of Public Health (MOPH) to integrate web-based malaria systems, logistic management information systems (LMIS), and other disease surveillance data into DHIS2. A transition plan was developed with the NMCP and DEPSI to manage this transition. DEPSI identified necessary malaria data elements, which PMM incorporated into DHIS2. By October 2020, the Madagascar MOPH had successfully integrated routine malaria data into DHIS2. This transition enhances malaria data infrastructure, benefiting the NMCP and other partners' data management and accessibility within the healthcare system.

10 countries enhanced DHIS2 data collection, analysis, or use

Mobile-Friendly Dashboard and Scorecard Applications

In Year 1, to facilitate data-driven decision making at the subnational level, PMM used core funds to develop mobile-friendly dashboard and scorecard applications (apps) designed to enable health facility and district staff to monitor and improve their malaria data quality and service delivery more systematically by capturing all available malaria data in the DHIS2 malaria module. In Year 2, PMM worked with NMCPs in **Côte d'Ivoire** and **Madagascar** to select and integrate malaria indicators and performance scores according to country context and performed demonstrations for stakeholders to finalize the apps.

In a Year 4 evaluation of the malaria scorecard and dashboard mobile apps, health facility staff reported that the apps provided immediate access to data. Health facility managers said the mobile apps provided stockout alerts, helped with problem identification and solutions, and enabled information sharing. In Madagascar, mobile apps helped identify coverage gaps in bed net distribution and enabled providers to take corrected action. As a result, mosquito net distribution increased by 69% between August 2021 and June 2022. Use of malaria dashboard and scorecard apps improved malaria service delivery and commodity stock management, increased health provider accountability to health facility performance results, and enabled monitoring of health facility action plans.

Lessons Learned

Collaboration and coordination through the establishment of TWGs and strategic document development helped define strategies for malaria SME. The development and revision of key governance documents, such as M&E and operational plans, demonstrate the significance of having well-defined and up-to-date strategic documents. These documents serve as roadmaps for malaria control programs, providing clarity on roles, responsibilities, and goals. Regular review and adaptation of these documents are crucial for staying responsive to changing needs.

The transition of malaria data into the DHIS2 platform in Madagascar underscores the value of integrated data systems. Consolidating various data sources into a unified platform improves data access, quality, and management. This lesson emphasizes the need for efficient data infrastructure to support decision making and resource allocation. New technologies such as mobile-friendly dashboard and scorecard apps also demonstrate the power of technology in enhancing data-driven decision making. These applications provided immediate access to data, helped identify issues, and enabled information sharing. Inconsistent internet connections, particularly at the subnational level, led to challenges using DHIS2 and in extracting and analyzing routine data.

RESULT 3: Enhanced Methods, Tools, and Approaches Applied to Address Health Information Challenges

PMM supported country partners to apply methods, tools, and approaches to collect, manage, and use data to provide valuable information for malaria programs and health system planning to drive health improvements. Countries are counted toward this result area when they use a method,

tool, or approach to address a health information challenge with support from PMM. The method, tool, or approach applied may be one that was developed or adapted by PMM (e.g. MECAT or MRDQA) or one that was developed externally. Over the course of the project, ten countries—Burundi, Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone—implemented methods, tools, and approaches to address health information challenges with PMM support.

10 countries applied a method, tool, or approach to address a health information challenge

Achievements

Monitoring and Evaluation Capacity Assessment Toolkit

MEASURE Evaluation developed the Monitoring and Evaluation Capacity Assessment Toolkit (MECAT) in 2017 to provide an approach for countries to document M&E performance objectives, assess their M&E capacity, and identify gaps and areas to strengthen. MECAT has been used successfully, including in Cameroon, Kenya, Mali, and Sierra Leone, to assess M&E capacity at national and subnational levels.

In Year 1, PMM worked with the NMCP in **Burundi** to conduct a baseline assessment of malaria SME capacity using MECAT. PMM adapted MECAT materials to Burundi's context and provided remote technical support to its NMCP to implement MECAT at the national and subnational levels. Findings revealed challenges in each of the assessment domains: insufficient human capacity for M&E, limitations in national and subnational databases, limited skills and expertise in evaluation and research, and limited data demand and data use. These findings were used to develop a comprehensive capacity-strengthening plan for malaria SME.

PMM also supported **Liberia's** NMCP to implement MECAT at the national level and with 15 county health teams (CHTs). The objectives of the survey were to determine SME capacity at all levels of the health system, measure the impact of MEASURE Evaluation's technical assistance, and understand current performance objectives and gaps to determine the most appropriate interventions to monitor and evaluate success in malaria SME capacity strengthening. The national MECAT found that high-quality tools, structures, and standard operating procedures (SOPs) had been established for most routine activities; however, the assessment also identified weaknesses in overall data demand and use, technical and financial autonomy, and human capacity for M&E. These findings were used to help identify priorities and next steps for capacity building for the NMCP as part of PMM's transition plan to the NMCP and other partners.

In **Niger**, PMM supported the review and implementation of the NMCP capacity strengthening plan based on findings of the previously implemented MECAT. To address these findings, PMM conducted a malaria SME training for central and regional NMCP staff to provide SME tools, techniques, and other resources needed for planning, monitoring, and assessing achievements of malaria control interventions in Niger.

Malaria Surveillance Assessment Toolkit

PMM, with the WHO Global Malaria Programme (GMP) and CHAI, finalized a standardized toolkit to assess the current performance of malaria surveillance systems. This toolkit provides a standardized, systematic approach to and guidance on implementation of the assessment across the malaria transmission continuum.

In Year 2, PMM adapted and implemented the malaria surveillance system assessment toolkit in **Cameroon**. The project collected data from 210 health facilities and conducted 66 interviews in three regions. PMM implemented the toolkit in the **DRC** in Year 3 to conduct a comprehensive baseline assessment in four provinces. The findings from toolkit implementation in Cameroon and the DRC provided the NMCPs with actionable and prioritized recommendations for strengthening the surveillance system for malaria control and elimination.

Malaria Routine Data Quality Assessment

MEASURE Evaluation's Malaria Routine Data Quality Assessment (MRDQA) tool, designed for assessing completeness, timeliness, and accuracy of malaria data, significantly enhanced data quality. The tool is customizable, user-friendly, and creates auto-generated dashboards for easy data visualization and outlines an action plan for addressing gaps identified. PMM used core funds to develop the MRDQA and implement it with NMCPs in nine countries.

In **Mali**, PMM financially and technically supported the NMCP to implement MRDQA in 44 health districts across five regions. The results were compiled by regional health office teams, and action plans were created to address identified gaps. PMM conducted 520 visits to 310 health facilities in 12 rounds of MRDQA.

In DRC, PMM supported all nine provinces to carry out two rounds of MRDQA focusing on reporting performance and system evaluation. Results from 2020 and 2021 revealed improved data accuracy in DHIS2, with underreporting decreasing from an average Verification Factor (VF) of 118% to 107% (a perfect VF score is 100% and acceptable range as defined in the MRDQA tool is 90%-110%) in indicators including suspected malaria cases, confirmed cases, and uncomplicated cases.

Côte d'Ivoire NMCP's Participatory Approach in Implementing Data Verification and Validation

In Côte d'Ivoire, PMM collaborated with the NMCP to enhance data accuracy and validation in 19 PMI-supported districts. Tools and guidelines were developed for data verification and aggregation to improve monthly reports and minimize errors. The data aggregation guidelines enabled weekly tally sheet checks. PMM also mentored regional and district teams to prepare monthly reports at the health facility level and strengthened supervisors' capacity to use MRDQA and data quality assessment tools, leading to a joint supportive supervision visit by the NMCP. As a result, data accuracy for selected indicators in 57 health facilities improved from 30% to approximately 60% between August 2020 and March 2021.

Malaria Portal

The core-funded Malaria Portal is an interactive online platform for use by PMI headquarters, Missions, NMCPs, implementing partners, and other RHIS stakeholders in PMI priority countries. The portal provides 21 country profiles capturing malaria data, as well as inventory documents related to RHIS resources and malaria. These profiles were updated annually in collaboration with the country team.

Site tracking has been added to measure the reach of the Malaria Portal. The portal received 4,782 visits from its launch in Year 1 until September 2023. Table 3 shows the number of downloads by country and report type, demonstrating document usage. Promoting the portal within the global malaria community will help to foster cross-learning and address gaps in individual countries.

Table 3. Number of downloads from the Malaria Portal by country and report type

Country	Report type	Count
	Comparison reports	14
Angola	Inventory	5
Angola	Malaria Profile	2
Angola	RHIS Profile	46
Benin	RHIS Profile	20
Burkina Faso	Inventory	4
Cameroon	Inventory	16
Cameroon	RHIS Profile	16
Côte d`Ivoire	Inventory	4
Côte d`Ivoire	RHIS Profile	17
DRC	Inventory	10
DRC	RHIS Profile	15
Ghana	Inventory	20
Ghana	Malaria Profile	1
Guinea	RHIS Profile	5
Kenya	Inventory	27
Liberia	Inventory	4
Liberia	RHIS Profile	3
Madagascar	RHIS Profile	6
Malawi	Inventory	15
Malawi	RHIS Profile	6
Mali	Inventory	33
Mali	RHIS Profile	9
Mozambique	Inventory	4
Mozambique	RHIS Profile	9
Niger	Inventory	14
Nigeria	Inventory	26
Nigeria	Malaria Profile	1
Nigeria	RHIS Profile	7
Rwanda	Inventory	3
Rwanda	RHIS Profile	7
Senegal	Inventory	7
Senegal	RHIS Profile	19
Sierra Leone	Inventory	6
Sierra Leone	RHIS Profile	6
Tanzania (Mainland)	Inventory	2
Tanzania (Mainland)	RHIS Profile	6
Tanzania (Zanzibar)	RHIS Profile	4
Uganda	Inventory	7
Uganda	RHIS Profile	15
Zambia	Inventory	1
Zambia	RHIS Profile	8

Data Dictionary Guidance

To analyze and interpret malaria indicators effectively, understanding their generation is crucial. While the DHIS2 platform provides data elements and formulas, this information may not always be readily available to users. Additionally, the WHO/GMP established a process to install the malaria module in countries but lacks a detailed protocol for creating and updating a malaria data dictionary. In response, PMM collaborated with the WHO/GMP and U.S Centers for Disease Control and Prevention (CDC) and used core funds to develop a standardized protocol for creation and maintenance of country-specific data dictionaries within DHIS2. This protocol ensures consistency in measurements, calculation methods, and indicator usage. It promotes accessibility for a wide user base, facilitating comprehension of data elements, disaggregation, indicators, calculations, numerators, denominators, and handling of historical data. PMM used core funds to develop tools and resources for country implementation of the dictionary and to present the data dictionary guide at the 33rd RBM SMERG meeting. In Year 3, PMM customized the data dictionary protocol according to country consultations and shared the guide with PMI and PMM countries in April 2023, piloting it in the DRC. The potential impact of the protocol for developing data dictionaries will be seen as more countries adopt it.

RBM SMERG Meetings

PMM used core funds to serve as a technical partner and secretariat for the RBM Partnership to End Malaria Surveillance, Monitoring, and Evaluation Reference Group (RBM SMERG) to ensure global coordination of malaria SME effort in malaria-endemic countries. As the Roll-Back Malaria (RBM) secretariat, PMM virtually hosted the 31st and 32nd RBM SMERG meetings in September 2020 and May 2021; hosted the 33rd meeting in a hybrid format in Kigali, Rwanda in May 2022; hosted the 34th meeting in-person in Seattle, Washington, USA in November 2022 during the ASTMH Annual Conference; and hosted the 35th meeting in Bangkok, Thailand in May 2022. During these meetings, the group discussed emerging SME needs and coordinated actions to improve malaria SME. Topics discussed at SMERG meetings that supported other PMM work included gathering best practices and challenges from implementation of the WHO malaria surveillance toolkit; determining how to standardize malaria bulletins produced by country NMCPs; discussing how to support expansion of electronic data reporting at health facilities to the community level; producing a generic digital roadmap to support sustainable expansion of electronic data reporting; and providing guidance on insecticide-treated net (ITN) campaign digitalization. Additionally, PMM worked to increase participation from malaria endemic-country professionals to ensure that SMERG guidance and tools address country needs and tools are effectively adapted and rolled out in endemic countries.

Lessons Learned

Implementing MECAT, MRDQA, and the malaria surveillance assessment toolkit enabled countries to identify SME needs and tailor interventions to improve data quality. MRDQA can be considered a best practice for malaria surveillance systems. To leverage project achievements, implementing partners should be trained to use MRDQA in non-PMI-supported areas. PMM's work with RBM SMERG improved coordination of malaria SME efforts and helped adapt tools and approaches to country contexts.

Project Impact

Countries Demonstrating Improvement in HIS Data Quality

Access to quality data is essential for NMCPs to make evidence-informed decisions to improve malaria programs and policies. To demonstrate improvement in data quality, countries must show advancements in accuracy, completeness, or timeliness of malaria-related data. Accuracy, also known as validity, refers to data that measure what they intend to measure and are considered correct. Accurate data minimize errors. Completeness means that an information system from which the results are defined is appropriately inclusive; it represents the complete list of eligible persons or units and not just a fraction of the list. Timeliness is achieved when data are current and when the information is available on time.

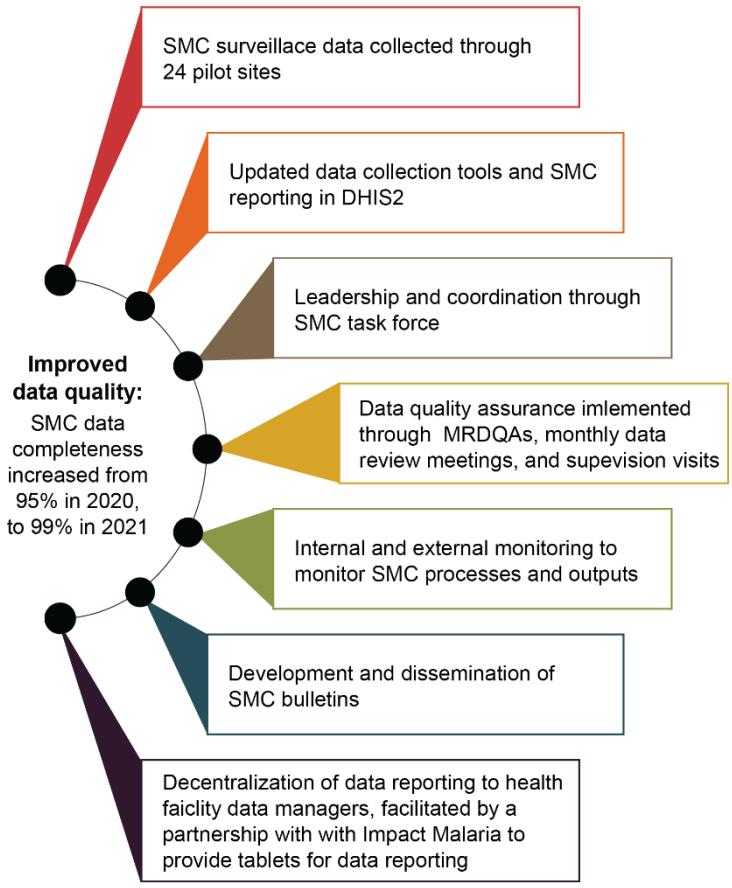
Demonstrating the project's impact on data quality necessitates showing tangible improvements in data completeness, timeliness, and accuracy, concerning malaria-related information. PMM conducted rigorous assessments,

6 **countries demonstrated improved HIS data quality**

including data quality assessments, desk reviews of routine data, and various other evaluations. These assessments documented improvements in HIS data quality in Cameroon, Côte d'Ivoire, the DRC, Kenya, Liberia, and Madagascar, underscoring the positive influence of the project's support in these countries.

M&E for Cameroon's 2021 Seasonal Malaria Chemoprevention Campaign Results in Improved Data Completeness

PMM worked with Cameroon's NMCP to improve and implement M&E for its annual SMC campaign. Through a multipronged approach, including integrating SMC campaign reporting into DHIS2, decentralizing data reporting to health facilities, implementing MRDQAs, and regularly convening data review meetings and supervision visits, the completeness of campaign data increased from 95% in 2020 to 99% in 2021.



Côte d'Ivoire NMCP's Participatory Approach in Implementing Data Verification and Validation in 19 PMI-Supported Districts Results in Increased Data Accuracy among the Assessed Hospitals, Rural Health Centers, and Urban Health Centers

In Côte d'Ivoire, PMM supported the NMCP to engage in a participatory approach in implementing data verification and validation in 19 PMI-supported districts. PMM collaborated with the NMCP in the development of data verification and aggregation tools and data element completeness guidelines to assist health facilities to better prepare monthly reports and avoid data aggregation errors and duplication. The data aggregation guidelines enable weekly intermediate counting in tally sheets. Following its health facility support, PMM worked with the NMCP and other partners to mentor regional and district teams on data verification and validation at the health facility level to prepare the monthly reports. The third technical approach was to strengthen supervisors' capacity to use MRDQA and routine data quality assessment tools and to conduct a joint supervision led by the NMCP. As a result of this approach, between August 2020 and March 2021, data accuracy—measured by data accuracy between monthly reports and data reported in DHIS2 being within the acceptable range of between 95–105%—among the 57 assessed hospitals, rural health centers, and urban health centers improved considerably for the selected indicators, from an average of 30% to approximately 60%.

Madagascar DEPSI's Coaching Approach Leads to Increased Timeliness and Completeness of Health Data Entered into DHIS2 By District Staff Between 2019 and 2020

In Madagascar, following the transition of routine malaria data from the global web malaria system to DHIS2, the NMCP and DEPSI recognized the need to sustainably transfer knowledge on entering routine malaria data in DHIS2 from recently trained central-level staff to the district-level managers responsible for entering monthly report data from health facilities into the system. Through the development and implementation of a coaching plan by DEPSI and PMM, central-level DHIS2 administrators began to oversee regions and districts on their use of DHIS2 by verifying the completeness and timeliness of data and troubleshooting any challenges. As a result of this process, the NMCP and DEPSI enabled more district staff to enter, analyze, and visualize malaria data. This led to an improvement in data quality between 2019 and 2020,

increasing the completeness from 86% to 91% and timeliness from 54% to 81%, of all health data entered into the DHIS2 by district-level staff.

Countries Demonstrating Improvement in Data Use Practices

8 countries demonstrated improvement in data use practices

While high-quality data are essential for data use, that alone cannot facilitate decision making. An array of strong and effective data use practices empower stakeholders to independently make informed decisions. "Data use practices" refer to a set of activities that enable stakeholders to make evidence-informed decisions to improve programs or policies. Data use practices can be observed at the national, subnational, and operational levels. Over the course of the project, Burundi, Cameroon, Côte d'Ivoire, Kenya, Liberia, Madagascar, Mali, and Sierra Leone strengthened practices in information-sharing and data use protocols.

Bulletins

In **Burundi**, PMM supported the NMCP to develop and validate a template for malaria bulletins. These templates were then used to produce the first issues of bulletins based on data from October–December 2020. PMM supported the NMCP and DSNIS to produce quarterly bulletins based on routine malaria data extracted from the DHIS2 database. Burundi's NMCP enhanced its ownership and autonomy over bulletin production by adapting the format and content of the malaria bulletins. In total, the NMCP produced nine issues of the bulletin. Quarterly bulletins ensured the availability of consistent and timely information products through which to disseminate malaria information to stakeholders.

Côte d'Ivoire's NMCP initially produced malaria sentinel surveillance bulletins in 2019, assisted by MEASURE Evaluation Phase IV. In 2021, PMM supported the NMCP to develop the 2021–2025 national SME plan, which mandates dissemination of validated malaria program data to inform stakeholders on the status of malaria activities, identify problems, and propose collective actions. The SME plan thereby institutionalized the quarterly sentinel surveillance bulletin as a national information product. The NMCP engages malaria stakeholders in quarterly data reviews to address quality issues, data analysis to monitor performance indicator trends, and discussions to understand these trends. The NMCP then works with PMM to develop the bulletin and incorporate feedback, present key findings to malaria program managers at different levels of the health system, and disseminate the final bulletin.

Liberia's NMCP demonstrated its commitment and capacity to produce information-sharing products through an increased independence in developing and disseminating quarterly malaria bulletins. The NMCP began producing malaria bulletins in 2019, with support from MEASURE Evaluation Phase IV. PMM continued to support the NMCP to develop and disseminate quarterly malaria bulletins. In Year 3, PMM transitioned the production of quarterly malaria bulletins to the NMCP. In 2021, the NMCP took on a leadership role in developing the bulletins, including data analysis, extracting, and writing. Throughout 2021, the NMCP developed all malaria bulletins. The malaria bulletins are disseminated among NMCP senior management and malaria partners, giving the NMCP an opportunity to share progress, achievements, and challenges, and to aid in informed decision making at the central and county levels.

In February 2023, PMM worked with **Madagascar's** DEPV and other stakeholders to develop a bulletin on routine immunization and COVID-19 vaccination data. The bulletin was disseminated electronically to all stakeholders and ensured consistent and timely sharing of immunization data. The DEPV plans to continue its development of the bulletin as a means to share routine immunization and COVID-19 data, best practices, and challenges.

PMM supported **Mali's** NMCP to develop 37 monthly malaria bulletins and to share digital copies of bulletins with stakeholders at the central and subnational levels. Bulletin dissemination facilitated monitoring of key indicators and the sharing of information to ensure timely action. PMM and the NMCP also supported six regions to analyze data and develop 42 quarterly malaria bulletins. For the first bulletin, PMM and the NMCP met with regional health teams to obtain buy-in for bulletin production and trained regional officers to extract and analyze data and write their first bulletin. For subsequent bulletins, PMM provided logistical support, reviewed and edited bulletins, and printed hard copies to support dissemination.

Kenya Introduces EPR Dashboard for Automated Malaria Epidemic Monitoring

PMM, with Kenya's DNMP, collaborated with the University of Nairobi Health IT project to develop the Epidemic Preparedness and Response (EPR) dashboard in the Kenya Health Information System (KHIS). In Year 2, PMM provided technical support to define the user requirements of the dashboard, including technical input on data visualization. PMM then supported the dashboard's rollout to all EPR counties through EPR planning workshops. The EPR dashboard allows users at all levels of the health system to identify health facilities that have surpassed alert and action thresholds for malaria epidemics, and to take timely action to mitigate the effects of outbreaks. Subcounty and county teams, as well as the DNMP/Disease Surveillance and Response Unit, can access summaries of the health facilities that have surpassed alert and action thresholds.

Liberia NMCP's M&E Team Leads the Development of a Data Demand and Use Training Curriculum

In Year 2, PMM provided technical support to Liberia's NMCP, Ministry of Health, and M&E team to develop a training curriculum for data use. The training aims to build malaria data use capacity to make health system decisions by creating demand for quality data for the purposes of decision making; improving data producers' and decision-makers' understanding of data use in decision making; and refreshing data staff on navigating DHIS2 to download, analyze, interpret, and present data. The curriculum included lessons on key terms, downloading and analyzing data from DHIS2, data sharing, and SME concepts.

Madagascar NMCP Institutionalizes a Coordination Process to Receive and Review Weekly Surveillance Data from DVSSER to Improve the NMCP's Access to IDSR Data

PMM supported Madagascar's Direction de la Veille Sanitaire, de la Surveillance Epidemiologique et Ripste (DVSSER) to organize three annual ISDR stakeholder meetings from 2020–2023. In total, 120 participants from the central level and 474 participants from the regional and district levels attended these workshops. During the workshops, participants analyzed IDSR system performance, identified issues, and provided solutions; reviewed TOR with an emphasis on data collection, analysis, reporting, and data use for decision making; defined IDSER information flow from the health center level to the central level; updated knowledge of key actors on weekly surveillance data reporting using SMS linked with DHIS2 surveillance hosted by the DVSSER surveillance department; and provided recommendations to improve surveillance systems. These workshops improved data availability at the health center level for electronic reporting, coordination between DVSSER and ISDR focal persons, involvement of private health facilities in IDSR data reporting, data management, and training for all staff involved in ISDR data collection and reporting at the health facility level.

Countries Supported by PMM That Have Used Malaria Information

Data from the HIS, assessment findings, or other sources can be used by stakeholders to inform key decisions or recommendations to improve programming or policy. Such decisions can take place at any level of the health system and yield important improvements in strategic planning, resource allocation, data collection and reporting procedures, and service delivery. An instance of data use occurs when stakeholders analyze or interpret the data generated from their HIS; from the application of methods, tools, or approaches; or from other sources that benefited from PMM support to suggest a recommendation or share information relevant to a program or policy area.

Data use includes using data in the formal decision-making process as well as data sharing, visualization, dissemination, and review by stakeholders. Malaria information can be used at the national, subnational, and operational levels. PMM documented use of malaria information to inform impactful decisions in nine countries—Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone.

9 countries documented use of malaria information

Cameroon Used Analysis of the 2022 SMC Campaign to Inform the 2023 SMC Campaign Strategy

In Cameroon, the NMCP has demonstrated data-informed decision making to plan for the 2023 SMC campaign. PMM supported strengthening of the NMCP's capacity to monitor and assess its annual SMC campaigns. Support to Cameroon's NMCP began under MEASURE Evaluation,

which included technical assistance for the implementation of the 2020 SMC campaign. In Year 1 of PMM, the project supported implementation of the 2020 SMC campaign; specifically, the project coordinated M&E of the campaign as well as follow-up and evaluation workshops. In Years 2 and 3, PMM continued support to implementation of the 2021 and 2022 SMC campaigns, including evaluation workshops.

The 2022 SMC evaluation workshop was held February 15–21, 2023 in Douala, Cameroon. In preparation for the 2022 SMC evaluation workshop, PMM conducted data analyses on 2022 campaign performance. PMM conducted a stratified analysis on SMC performance in routine vs. campaign districts and created a refined criteria for the health districts eligible for different SMC strategies, considering the WHO selection criteria (≥60% of malaria cases occurring within 4–5 months of the transmission season). These analyses used DHIS2 and satellite data, mainly >5 malaria morbidity data from the DHIS2 and rainfall information from satellite data. Based on evidence provided by PMM at the SMC evaluation workshop, the NMCP adjusted the 2023 SMC campaign strategy, in consultation with PMM and PMI. Reflecting the changes to the SMC strategy, 31 out of 47 health districts in the North Region and Far North Region started SMC in June 2023, as opposed to July, before the first peaks of malaria transmission. Additionally, 14 districts will conduct the campaign in five cycles rather than the routine four cycles. Use of malaria data to inform annual SMC campaign strategy demonstrates the NMCP using data to inform its decision making for a key recurring malaria program.

Stratification of Malaria Transmission Data Improves Program Planning

PMM supported country NMCPs to analyze data to produce malaria transmission stratification by subnational regions.

PMM supported **Côte d'Ivoire's** NMCP in improving planning for the 2024 mass long-lasting ITN distribution campaign. In 2019, the NMCP used malaria incidence and entomological data to stratify health districts. Districts were classified into four endemicity levels: very high (39 districts), high (45 districts), medium (22 districts), and low (7 districts). Entomological surveys determined whether districts received standard ITNs or new types of nets. In 2022, after the 2021 campaign, the NMCP received feedback indicating insufficient reduction in malaria. Using data analysis skills acquired through PMM support, the NMCP revisited the stratification. The reanalysis led to the conclusion that only 24 health districts still needed standard ITNs, while 89 districts required new types of ITNs due to the presence of insecticide-resistant mosquitoes. Planning for the 2024 campaign is now based on this updated information, highlighting the NMCP's commitment to data-driven decision making.

In 2021 and 2022, PMM supported **Kenya's** DNMP to update the national malaria transmission risk map using data from the KMIS 2020 and other data sources. The updated risk map initiated the discussion on subnational tailoring of malaria control interventions based on changing malaria transmission risk. Findings from the malaria stratification informed malaria programming. For example, Turkana County was added to routine mass ITN distribution because of increased malaria transmission in the county.

In **Mali**, PMM and partners used routine data from 2017–2019 malaria incidence, 2018 Demographic Health Survey malaria prevalence, 2019 meteorological data, and 2010–2019 entomological data to stratify malaria transmission by district. This revealed 24 high-transmission districts, with varying transmission periods (two to six months, or year-round). The NMCP adjusted its SMC strategy in 2022, thus discontinuing SMC in very low transmission areas. In low, moderate, and high transmission areas, SMC cycles were adapted: two districts had two cycles, 10 had three cycles, 32 had four cycles, and 15 had five cycles per transmission season. IPTp for pregnant women was stopped in very low transmission areas, and new types of ITNs were distributed in high-transmission areas with reported insecticide resistance.

In 2020, PMM developed subnational malaria risk stratification profiles in **Sierra Leone** and updated the profiles annually. The updated risk map supported program decision making for better tailoring of malaria interventions at the district and chiefdom levels. Malaria risk stratification informed the 2023 ITN campaign forecasting, supporting the planning process of malaria vaccine introduction, and helped rationalize Global Fund support during the 2023 grant writing phase.

Côte d'Ivoire's NMCP Uses Supervision Findings to Update National Malaria Case Management Guidelines

The NMCP updated national malaria case management guidelines based on joint supportive supervision visits and data accuracy checks. These visits revealed data inaccuracies due to misunderstandings of indicators and noncompliance with national guidelines. For instance, not all uncomplicated malaria cases received the recommended ACT despite its availability.

PMM supported the NMCP in writing supportive supervision reports highlighting issues, achievements, and solutions, including on-site orientation sessions for better understanding of indicators, guidelines, and data tools.

In March 2022, the NMCP held a workshop in Yamoussoukro to revise national malaria policy and case management guidelines. The guidelines were updated in response to findings from the supportive supervision report and disseminated through regional and district orientation sessions. As a result, healthcare providers' understanding of suspected malaria case management improved, leading to higher numbers of fever cases undergoing malaria diagnostic testing.

Niger's NMCP Uses Findings of Malaria Quantification Exercise to Implement Supply Chain Approach for Malaria Quantities

After consistently observing ongoing malaria commodity stockouts based on end user verification survey data, Niger's NMCP M&E team conducted a commodity quantification exercise with technical support from PMM. The objective of this exercise was to match quantities of malaria commodity stockouts to the assessed needs in the field to avoid future stockouts. PMM was asked to participate due to the implications of malaria commodity data on malaria case reporting and data quality, with the project extracting data and overseeing analysis methods. Data from 2019 were reviewed, including health coverage data based on populations living within five kilometers of a health facility and DHIS2 data. In June 2022, the NMCP used a calculation approximating health service coverage to estimate commodity quantities slightly greater than historic quantitates yet still reflecting current commodity trends. The NMCP plans to monitor commodity stocks with pharmacists and to assess the status of stockouts with stakeholders.

Madagascar's Directorate of Family Health Used a Built-In DHIS2 Dashboard to Identify, Investigate, and Address Data Quality Issues

Madagascar's Directorate of Family Health (DSFa) used the DHIS2 dashboard developed with PMM at its quarterly data review meeting. The DSFa identified districts outside national data quality targets and created action plans for Amoron'i Mania and Vakinankaratra regions. The DSFa visited these regions, finding value discrepancies between health facility registers, monthly reports, and DHIS2 due to unclear indicator definitions. Recommendations included clarifying indicator definitions, such as the definition for family planning methods. Issues were noted with counting for both new and existing patients in reports, resulting in the recommendation for increased training on accurate counting and reporting.

Challenges and Lessons Learned

Bulletins promote timely information-sharing with stakeholders. However, generating data for malaria bulletins often requires the time-consuming process of manual data analysis, which can lead to delays in bulletin production and dissemination. Furthermore, bulletins are not always widely distributed to stakeholders and, when they are, there is not always a clear plan for using information from malaria bulletins to inform program implementation. Thus, to share bulletins more efficiently and ensure they contribute to malaria data use, malaria bulletins should be published online, promoted, and made available in the public domain, and there must be a clear plan for how to use malaria SME data.

Malaria SME trainings at the national and subnational levels improve capacity for data use in decision making. Capacity-strengthening efforts must empower stakeholders at all levels in the decision-making process.

Project Operations

Structure and Activities in Support of Project Management

The University of North Carolina at Chapel Hill (UNC) served as the prime contractor for the PMM project. Over the course of the project, UNC led financial and operational management as well as project documentation of PMM project deliverables and results. The PMM partners consortium—composed of ICF; John Snow, Inc. (JSI); Palladium International, LLC; and Tulane University—was

responsible for scopes of work. Through the life of project (LOP), PMM partners supported 19 core-funded activities and 38 field-funded activities, working collaboratively with 10 PMI partner countries in Africa: Burundi, Cameroon, Côte d'Ivoire, DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone. Each individual activity included a specific scope of work, milestones toward achievement of deliverables, and a budget. To effectively manage the project, UNC established efficient processes and effective tools for communicating, coordinating, reporting, and documenting achievements, learning, and outcomes.

Communications

To ensure the timely exchange of ideas and updates to move the work forward, the PMM project instituted a system of periodic meetings, at both the country and U.S. levels.

Monthly PMM country team calls were conducted between the country team and U.S.-based staff to review progress and identify and resolve issues efficiently. Participants included the Country Malaria SME Advisor and/or technical advisors, the PMM U.S.-based operations and technical directors, and the monitoring, evaluation, and learning (MEL) officer. In all, nine countries held recurring monthly meetings, with Côte d'Ivoire convening meetings on an as-needed basis.

USAID Country Mission and PMM monthly team meetings were held with missions upon request. Wherever applied, this touchpoint was included in PMM country work plans. Attendees included Mission staff (Agreement Officer's Representative [AOR], technical), PMM country staff (Malaria SME advisor, technical staff), and PMM U.S.-based staff (operations, technical, & MEL, with finance and contracts, as needed). These gatherings allowed three-way communication to discuss work plan implementation status and resolve any technical or operational field issues. USAID/Washington was included in the invite and regularly attended unless unable. Across the life of the project, all countries held these meetings, with nine countries convening monthly meetings and Mali holding bimonthly calls.

The PMM biweekly management meeting convened the USAID/Washington management team and PMM senior management, as well as PMM operations, technical, MEL, and finance staff. These meetings allowed for regular internal discussion between USAID/Washington and PMM management to guide overall project strategy and to proactively address challenges and opportunities as they arose.

The PMM-USAID/Washington bimonthly technical meeting served as a forum for USAID/Washington technical staff and PMM management to provide updates and discuss areas in need of additional clarity or support.

Ad-hoc PMM meetings and calls were held as needed at the PMM country level, as well as with USAID/Washington, to nimbly address any time-sensitive technical or financial concerns.

Meetings of the Operations Director with the MEL Officer and KM Director occurred on an as-needed basis to ensure efficient functionality across the PMM KM and MEL units, to identify and plan projected KM and MEL needs, and/or to address issues.

Biweekly Measure Program Senior Management Meetings (SMMs) were held at UNC to convene senior managers involved with the different USAID-funded Measure Program projects. The meetings allowed for cross-fertilization of ideas and strategies to overcome challenges, as well as the sharing of best practices.

Measure Program all-staff quarterly meetings were internal UNC meetings composed of all staff involved with Measure Program projects. These meetings served as opportunities for PMM to both share about the project internally as well as for the PMM UNC team to learn from the other USAID-funded projects in a large group discussion setting. Meeting quarterly ensured all staff had general knowledge of current activities, recent achievements, and key deliverables of all Measure Program projects. The meetings also aided in training staff ahead of reassignment or provision of temporary project support.

Work Plans in Support of Project Management

All field and core activities conducted by the PMM project were guided by USAID-approved work plans. The initial project work plan was developed within 90 days after project signing and subsequent annual work plans were created according to identified needs and updates, including adding to or curtailing activities as needed. Work plans serve to describe all facets of activities to be executed, including timelines, expected results/deliverables, and budget.

Project Management Information System

Under MEASURE Evaluation Phase III, UNC established a comprehensive management information system (MIS) designed to allow for continuous updates on project progress, including dashboards and tools for data aggregation and analysis. The framework of this MIS was adapted for the PMM project.

The MIS was designed to collect information rapidly and efficiently on activity progress against USAID-approved work plans. Both quantitative and qualitative data elements were tracked through the MIS, allowing one to monitor activity implementation and spending, identify and address issues, and, finally, to synthesize results to inform project learning on a regular, ongoing basis.

The MIS is accessible to USAID/Washington, allowing for the dynamic assessment of project progress against timelines and deliverables.

The MIS has been an essential tool for project operations, ensuring, among other functionalities:

- Databases for each individual activity present in both the core and field work plans;
- Description of activity, responsible person(s), reporting requirements, deliverables, current status (not started, in process, completed);
- Text fields providing additional context to numerical measures;
- Data entry sections allowing activity managers and project partners to enter and edit data for the current period;
- Dashboards and summary tables summarizing overall project metrics; and
- Report templates to ensure timely reporting, using a common format to facilitate exploration by readers.

Internally, the project's MEL team utilized the MIS on an ongoing basis when reviewing progress updates. As part of this process, the team flagged present or potential issues with activity implementation and brought them to the attention of project management for corrective action.

Project Results System

Midway through the course of the PMM project, systematic collection and documentation of project outputs and outcomes were further expanded by developing and institutionalizing an open project results system. This platform is accessible to all staff, as well as USAID/Washington, and links with the project MIS to clearly list project results based on the PMM MEL Plan results framework.

Project Closeout and Transition of Support to Other Partners

Closeout Meetings

The project organized an overall closeout event and country closeout meetings from January–October 2023 (Table 4) to celebrate PMM's achievements and discuss lessons learned, and to show appreciation for the efforts and achievements of the project's team members.

Table 4. Country closeout event dates

Country	Closeout date
Overall project closeout event	January 31–February 3, 2023, Nairobi, Kenya
Burundi	April 11,2023 – Bujumbura
Côte d'Ivoire	April 12, 2023 – Abidjan
Cameroon	October 3, 2023 – Yaoundé
DRC	March 22, 2023 – Kinsasha
Kenya	July 11, 2023 – Nairobi
Madagascar	June 22, 2023 – Antananarivo
Mali	June 27, 2023 – Bamako
Niger	March 6, 2023 – Niamey
Sierra Leone	May 31, 2023 – Freetown

Overall Project Closeout Meeting

Closeout meeting participants, photo by Yazoume Ye

PMI panel discussion, photo by Yazoume Ye

As PMM approached its final year of implementation, an end-of-project event was held in Nairobi, Kenya, in February 2023, with all PMM project staff (technical, operations, and support) from the United States and country teams from Cameroon, Côte d'Ivoire, the DRC, Kenya, Madagascar, Mali, Niger, and Sierra Leone. The PMI project management team, PMI/Kenya advisors, and representatives from Country Health Information Systems and Data Use (CHISU) also attended. The meeting theme was *"PMM legacy: Achievements and lessons learned,"* and it provided an opportunity to celebrate the project's achievements, to discuss lessons learned, and to plan for ending the project well. The theme emphasized the importance of reflecting on the journey, gleaning valuable insights for future projects, and appreciating team members for their valuable contributions to the success of the project.

The meeting proceeded successfully with key activities including panel discussions, question and answer sessions, and group brainstorming. All objectives were met and participant questions and concerns addressed, including key take-home messages.

Country-Specific Closeout Meetings

PMM, in collaboration with NMCP programs, organized country-specific project closeout meetings from March–October 2023 in Burundi, Cameroon, Côte d'Ivoire, the DRC, Kenya, Liberia, Madagascar, Mali, Niger, and Sierra Leone (see Table 3). These meetings were well attended, bringing together 30 to 80 participants from the project staff (country and headquarters), PMI/country team, NMCP, HIS departments, subnational level representatives, and other partners (including WHO, Global Fund, private sector, and PMI implementing partners). In all countries, the meetings were officiated by senior authorities from the Ministries of Health and USAID missions. During the closeout meetings, PMM presented project achievements, enablers, challenges, lessons learned, and recommendations for future support. In addition to the formal presentations, a poster session was organized to show key project achievements and, for two countries (DRC and Kenya), a short video projection. These meetings provided opportunities to thank all the collaborators and project teams. Partners expressed their appreciation to the project team for their excellent work in improving SME and HIS in their countries. The meetings concluded with an official handover of the project's key electronic versions of tools, resources, and documents to the NMCPs.

Transition Planning

The transition and handover process started with the development of a handover plan for individual core activities as well as field activities in each country. In addition, the project team ensured the close monitoring of funds for accurate projections and spending through monthly review of pipelines.

Core Activities

Four out of PMM's twelve core-funded activities were handed over to CHISU following project closeout, building upon PMM's achievements addressing malaria SME needs. CHISU will support the RBM SMERG secretariat and has been handed all the required documents after their involvement in the last meeting PMM supported in Thailand. CHISU will support regional malaria SME courses run by AFENET and CRSN by providing fellowships for course participants. The malaria portal was handed over to CHISU following several meetings to discuss the platform's content, features, and functionality. Lastly, CHISU will support rollout of data analysis and visualization apps that PMM piloted in Côte d'Ivoire and Madagascar.

Field Activities

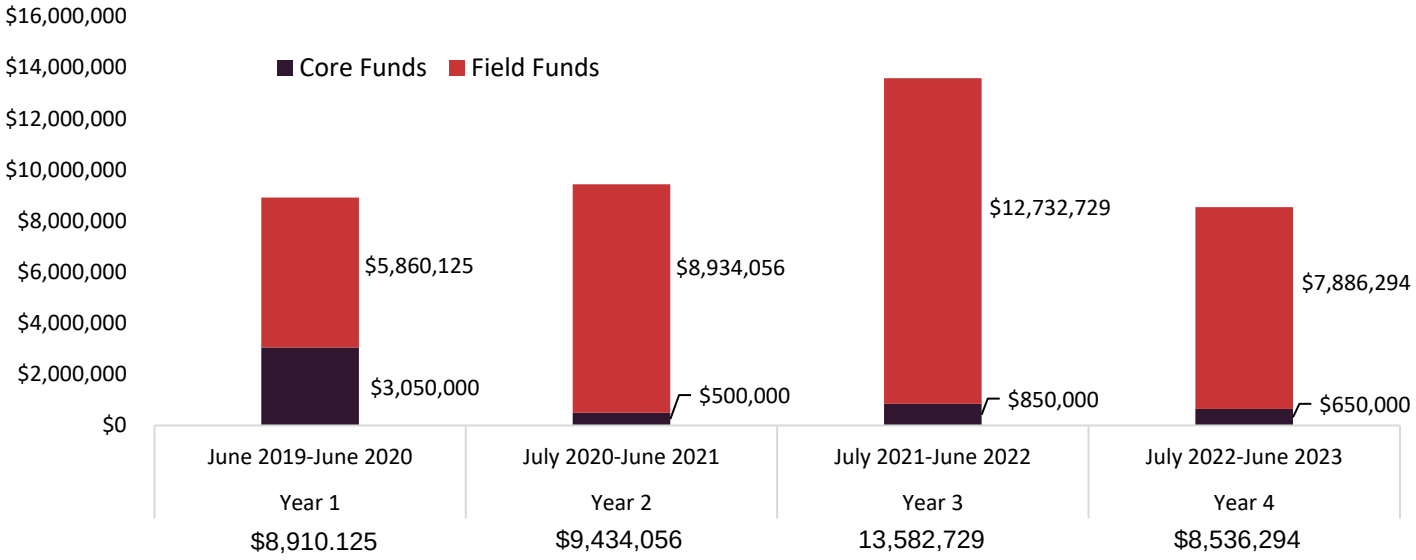
To ensure a smooth transition in countries, PMM's team engaged with the PMI/country team, the NMCP CHISU team (where present), and other key stakeholders to develop a comprehensive transition plan to guide the process. The objectives of the country transition plan were (1) to identify key technical activities and resources to be transitioned to the NMCP or any other implementing partner in collaboration with the NMCP and PMI/country team, in order to ensure continuity of activities and sustain gains in malaria SME capacity; and (2) to document PMM achievements and describe the project's closeout. The transition plan served as a reference document for CHISU.

After each of the project's official country closeouts, PMM drafted country-specific end-of-project reports highlighting all project achievements and documenting the steps/processes put in place to achieve them, as well as a list of key resources. These reports describe existing gaps and lessons learned and offer potential recommendations for consideration by CHISU. Country end-of-project reports were shared with the PMI/country teams.

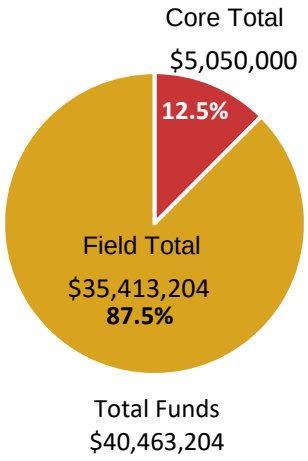
Financial Summary

At the time of the initial award in June 2019, the PMI Measure Malaria ceiling was $35,942,805 for the five-year project period. However, early in the third year of project implementation, it became apparent that this ceiling amount would not be sufficient to meet demand for project work from field missions, so the process for increasing the ceiling was started. In January 2022, the overall ceiling was increased by $5,115,210 to a total of $41,058,015. Even with this increased ceiling, project activities had to be transitioned to other mechanisms at the end of project Year 4 because the remaining ceiling was insufficient to allow for an entire fifth year of operation. Project technical activities were wrapped up in October 2023.

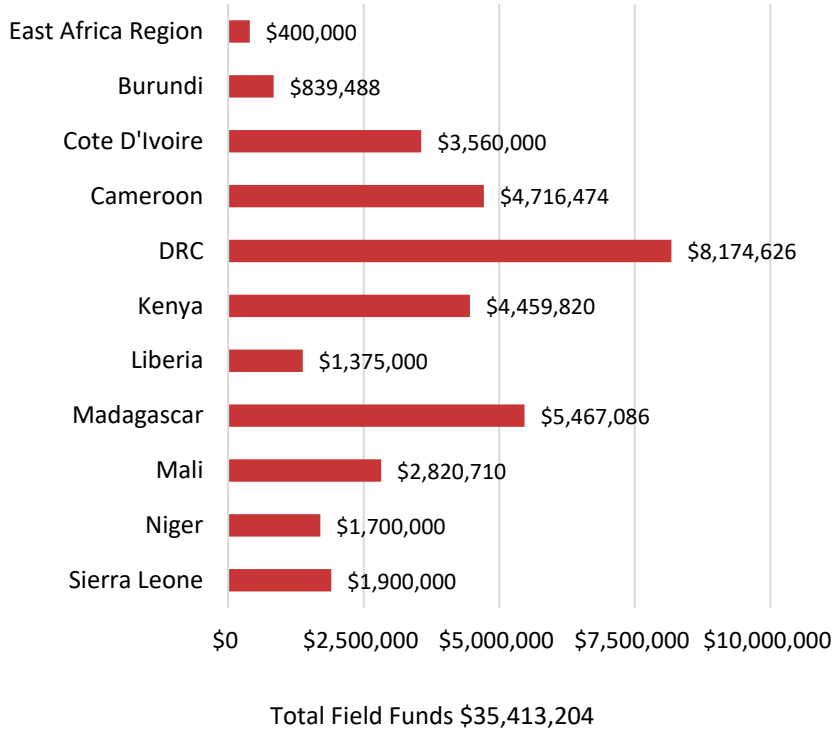
The total funding obligated to the project was $40,463,204, distributed across project implementation years as follows:



The majority of funds received (87.5%) were from field missions.



Total Field Funds Obligated by Country/Region



In total, PMI Measure Malaria took in funding from ten different country missions as well as the East Africa Regional Bureau. The largest budgets by country were in Cameroon, the DRC, and Madagascar.

The total obligated funds were spent in accordance with annual work plans that were negotiated and approved by the project AOR.

Three major partners assisted UNC in the implementation of this award:

Partner Name	Total Subcontracted Amount
ICF Macro Inc, (ICF)	$27,081,463
John Snow, Inc (JSI)	$7,185,686
Tulane University	$657,436

All assets and equipment purchased under PMI Measure Malaria have been disposed of in accordance with 22 CFR 226.34, 22 CFR 225.35, and organizational policies. For mission-funded purchases, mission approval, AOR approval, and Agreement Officer approval was received for disposition plans for all assets that had a useful life at the end of project. In all cases, the project placed emphasis on disposing project assets to other USAID-funded global health mechanisms when appropriate.

UNC submitted quarterly financial reports, SF425, in accordance with 22CFR 226.52. Reports were submitted in electronic format to the AOR and to the M/FM/CMP-LOC Unit per the agreement requirements. UNC reports finances on a cash basis accounting method. UNC submitted quarterly expenditure reports for approval by the AOR no later than 45 calendar days after the end of each quarter. The quarterly expenditure reports included activity codes, obligations by code, expenditures to date, and remaining pipeline. In addition to agreement requirements, the project submitted quarterly accrual reports to field missions and other ad hoc financial reports upon request from the AOR or mission staff.

Project Monitoring, Evaluation, and Learning (MEL)

Malaria Information Index

PMM's Malaria Information Index (MII) is a central, project-specific measuring and tracking tool developed to systematically collect data to inform the project's Collaborating, Learning, and Adapting (CLA) approach. Findings from each application of this tool provide yearly opportunities to pause and reflect on best practices and lessons learned that can inform decision making and planning for the next year of the project.

The MII is a project-specific measurement and tracking tool that measures progress toward achievement of results related to increased country capacities to (1) collect, analyze, and use routine data; and (2) manage HIS, data quality, and data use. PMM worked with malaria SME advisors to collect three rounds of MII data in eight PMM-supported countries—Cameroon, Côte d'Ivoire, DRC, Kenya, Madagascar, Mali, Niger, and Sierra Leone. Data collection occurred during Round 1 in June 2020, Round 2 in November 2021, and Round 3 in November 2022. PMM disseminated findings at two cross-fertilization meetings and during the project closeout meeting, which provided an opportunity for staff to learn about trends in HIS and malaria SME strengthening across countries, in addition to common challenges.

PMM developed comprehensive baseline briefs synthesizing findings across data management, data quality, and data use. These briefs were updated following each round of data collection, with final versions shared with USAID, country NMCPs, and PMI country teams for programming and prioritization.

Malaria Information Index scores from Round 1 (baseline), Rounds 2 and 3 of implementation, as well as changes noted from Rounds 1–3 of implementation, are shown in Table 5. The scale is organized into six domains with 18 components scored on a scale of either 1–3 (with 3 being the highest score) or 1–5 (with 5 being the highest score).

Under "Domain 1: Leadership and Governance," countries enhanced their "Strategic Planning" and "M&E Plan" scores by employing adaptive management strategies like annual malaria reviews and midterm assessments, using malaria data to prioritize program needs. As a result, scores in those components increased by 0.8 points from Round 1 to Round

3. Progress in "Malaria Surveillance Guidance" and "Leadership and Coordination" resulted from the systematic implementation of the WHO-recommended surveillance guidelines, increasing the "Malaria Surveillance Guidance" score by 1.4 points. National oversight, such as Kenya's quarterly COE meetings, increased the "Leadership and Coordination" score by 1.3 points.

Scores for "Workforce Training" improved through SME curriculum development, leading to a 1.1-point increase from Round 1 to Round 3. Partner engagement positively impacted the "System Standards and Interoperability" domain.

However, improvements in these domains were somewhat limited, as these components weren't directly supported by PMM. MRDQA and data quality review meetings identified data quality issues and guided quality improvement plans, leading to better scores in the "Data Quality and Management" domain. Enhanced access to DHIS2 data contributed to improved data availability.

All aspects of the "Data Use" domain saw improvements. For instance, Madagascar developed a data use plan, Sierra Leone engaged data users in national and subnational meetings, and increased data use capacity was achieved through updated malaria stratification maps. See Appendix 3 for more information on Malaria Information Index findings.

Table 5. Malaria Information Index scores

Domain	Component	Round 1	Round 2	Round 3	Change R1 to R3
Domain 1: Leadership and Governance	Strategic planning	4.1	4.5	4.8	0.8
	M&E plan	3.6	4.1	4.4	0.8
	Malaria surveillance guidance	2.4	3.2	3.8	1.4
	Leadership and coordination	2.5	3.4	3.8	1.3
Domain 2: Workforce	Training	2.1	2.6	3.2	1.1
Domain 3: ICT Infrastructure	LAN and WAN	2.4	2.8	2.8	0.4
	Hardware	2.0	2.8	3.0	1.0
	Operations and maintenance	1.6	1.8	1.9	0.3
Domain 4: System Standards and Interoperability	Technical standards	2.4	2.5	2.6	0.3
	Data and exchange standards	2.3	2.9	2.9	0.7
Domain 5: Data Quality and Management	Data quality	3.1	3.7	4.1	0.9
	Information/data availability	3.6	4.1	4.4	0.8
	Data collection, analysis, and use	3.3	3.4	3.6	0.4
Domain 6: Data Use	Data use plan	1.6	2.1	2.4	0.8
	Synthesis and dissemination of information products	1.8	2.3	2.2	0.4
	Engagement of data users	1.5	1.8	2.1	0.6
	Capacity for data use	1.4	1.6	1.9	0.6
	Identification of data needs	1.5	1.5	2.4	0.9

Strengths and Challenges of Implementing The Malaria Information Index

Index scale definitions for each component provided specific benchmarks by which to measure malaria SME and HIS strengthening over the three rounds of implementation. The Malaria Information Index captures a holistic picture of malaria SME and HIS, including areas beyond PMM's scope of work that were still measured due to their contributions to the overall landscape of malaria SME and HIS. Capturing data on all components across the three rounds showed the changes that PMM contributed to and revealed areas where further work was needed. Collecting qualitative comments alongside quantitative scoring provided rationale and evidence to help contextualize scores. Translation of the workbook and user guidance into French was vital for collecting qualitative information in Francophone PMM-supported countries.

By Round 2 of data collection, it was evident that though progress was being made in specific areas, the scoring would not always reflect this (the scores would remain static as not all aspects of the individual scale scores had been achieved). To better show where progress was being made, half-scores (.5) were allowed in Rounds 2 and 3 to reflect progress made toward the next scale level, while still showing where work was needed. For Round 3, the MEL team revised the wording of some scale definitions to improve clarity and ease of understanding. The team was intentional in trying to avoid changes that would affect the previous year's scores.

Learning Priorities

PMM's work informs ongoing learning and adaptation through the project's learning priorities, which aim to build an evidence base for technical strategies that strengthen data quality and the analysis and use of data to improve programs and policies. PMM examines and synthesizes project learning through three questions:

1. Which technical strategies can be considered best practices for strengthening malaria surveillance systems?
2. How does strengthening malaria SME influence the larger HIS in a country?
3. Which technical strategies can be considered best practices for stimulating data use for decision making at all levels of the health system?

Table 6 summarizes insights from learning questions, as well as challenges encountered during program implementation.

Table 6. Strengths and challenges based on PMM learning questions

Learning question	What are best practices for strengthening malaria surveillance systems?	How does strengthening malaria surveillance, monitoring, and evaluation (SME) influence the larger health information system (HIS) in a country?	What technical strategies can be considered best practices for stimulating data use for decision making at all levels of the health system?
Strengths	• **Coordination** with NMCPs and implementing partners is essential for strengthening malaria SME. Collaboration helps sustain gains and increases reach of interventions through cost-sharing or division of implementation and prevents duplication of effort.	• **Coordination** between country NMCPs and implementing partners ensures that all stakeholders have timely **access to data** for decision making.	• Producing timely, well-designed **malaria bulletins** and disseminating them to stakeholders helps improve and institutionalize the culture of data use for decision making • **Data use plans** can help ensure that information from malaria bulletins

	• Developing **operational and action plans** with NMCPs and implementing partners supports ongoing monitoring of SME and HIS strengthening activities. Review of these plans, as well as **review of strategic documents** and M&E plans, informs improvements based on ongoing needs. • NMCP- and MOH-validated **training curricula** for malaria SME helps strengthen malaria surveillance systems. Technical ownership of workforce training by the NMCP increases NMCP ownership of the activity and helps ensure that training and capacity strengthening will continue after PMM support ends. • **MRDQA and data review meetings** help identify and address data quality issues. Training partners to implement MRDQA in non-PMI-supported counties helps maximize impact and supports sustainability. • **Country ownership** of activities is key to successful implementation and sustaining activities after PMM support ends. **SME TWG meetings** and **bulletins** are NMCP activities, making them easier to hand over when the project closes. Promoting country ownership and engagement from the beginning of PMM activities ensured there was complete buy-in from leadership at country NMCPs. When countries see the value of PMM activities, they are more likely to continue the activities.	• PMM's work with NMCPs to develop and update **M&E guidance and surveillance guidance** helps improve SME in other health areas. • Assessing surveillance and leadership helps country NMCPs **identify SME, HIS, and leadership strengthening needs and priorities.** • Malaria SME tools can be **adapted across health areas,** including maternal and child health and immunization.	is used to inform program implementation. • **DHIS2 dashboards and modules** help facilitate data visualization and use at all levels of the health system. The ability to quickly and easily display relevant information supports data-driven decision making and improves efficiency, helping to improve healthcare delivery. • **Coaching and mentoring** empower stakeholders at all levels to use data for decision making. • Increased frequency of **data review meetings** and official data review guidance results in heightened interest in using data for planning.
Challenges and opportunities	• Scheduling conflicts and competing priorities for NMCPs regularly affect convening TWG meetings. • Limited internet connections where DHIS2 access is needed hampered data collection. • Partners should implement MRDQA in areas not currently supported by PMI.	• Limited availability or knowledge of surveillance guidance makes operationalization at all levels of the health system difficult.	• Delays in generating complete data are a challenge to timely production and dissemination of malaria bulletins. • Future projects should place increased emphasis on coaching and mentoring of the NMCP and staff to promote and sustain data demand and use.

Conclusion

From June 2020 through September 2023, PMI Measure Malaria worked in 10 countries to build capacity for malaria surveillance, monitoring, and evaluation and foster a culture of malaria data use. PMM strengthened country capacities to collect, analyze, and use routine data through data review meetings that improved the quality of malaria data; through mentorship and supportive supervision to improve data quality at the health facility level; and through core-funded capacity strengthening, including East Africa Hub webinars, regional trainings in collaboration with AFENET and CRSN, and online Anglophone and Francophone SME courses. PMM strengthened country-level capacities to manage HIS through establishment of TWG meetings that encouraged collaboration between implementing partners; development, review, and updates of key governance documents including strategic and M&E plans, roadmaps, and malaria surveillance guides; and enhanced use of DHIS2 to improve data access, quality, and management. PMM introduced methods and tools to address health information challenges, including core-funded tools such as MECAT, MRDQA, Malaria Portal, and a guide to developing malaria data dictionaries.

These achievements led to demonstrated improvements in malaria data quality and use. Five project-supported countries demonstrated improvements in HIS data quality. Eight countries demonstrated improvements in data use practices, including information-sharing and data use protocols, enabling stakeholders to make data-informed decisions. PMM documented instances of data use to inform decision making, programming, and/or policy in nine countries at the national and subnational levels.

Challenges

Rising COVID-19 cases in several project countries led to challenges for PMM activities, including restrictions that prevented in-person activities such as meetings for data review and TWGs, field visits, and training. PMM worked to mitigate delays to these work plan activities by revising project timelines and facilitating virtual meetings when feasible. These challenges underscored the importance of building SME systems resilient to emerging threats, including future pandemics, as well as disease outbreaks, natural disasters, and conflict.

While technology helped facilitate activities amidst COVID-19 disruptions, it also introduced challenges. Inconsistent internet connections, particularly at the subnational level, made participation in virtual activities challenging for some health facilities. Internet connectivity issues also affected consistent and timely data reporting and review.

Collaboration with NMCPs and other partner institutions also presented challenges. Scheduling conflicts and competing priorities with NMCPs, particularly leading up to and during malaria control campaigns, led to delays in country scope of work timelines. Furthermore, the COVID-19 pandemic led to increased demand for the countries' health systems, resulting in competing priorities with the NMCPs that delayed country work plan timelines. In response, PMM reworked timelines to reschedule deliverables and technical work.

Lessons Learned and Recommendations

Engagement with the global malaria community, such as through RBM SMERG, and active participation in international conferences enhanced alignment between country-specific needs, emerging malaria SME priorities, and the available global tools.

Discussions during the Malaria Information Index cross-fertilization meetings showed demand for increased subnational-level support for data collection, quality improvement, and use. The meetings following Round 3 of the Malaria Information Index, as well as end-of-project interviews with country leads, indicated that investment in subnational support is a best practice for strengthening malaria SME and stimulating data use. Subnational capacity strengthening activities such as mentorship and coaching are cost-effective and efficient methods for transferring knowledge to a large pool of health workers. During project closeout activities, country leads recommended that in future projects, community health workers should be leveraged to improve surveillance and measurement of malaria at the subnational level.

Malaria SME achievements should be leveraged to assist non-PMI-supported geographies of project countries. Leveraging buy-in of MRDQA led Cameroon, Côte d'Ivoire, and Kenya to advocate for the Global Fund and other partners to expand MRDQA use to non-PMI-supported regions.

Collaboration between PMM, NMCPs, and implementing partners contributed to the project's success. Creating environments such as TWG meetings, where the NMCP, implementing partners, and other stakeholders could interact, improved collaboration, facilitated the sharing of information

and resources, and helped avoid duplication of effort. PMM's collaboration with the NMCPs, and its flexibility in adapting project activities to align with country priorities, helped achieve project results. Country leads shared that NMCP ownership of tasks was crucial for successful implementation and will make countries more likely to continue activities after PMM support ends. Over the course of the project, NMCPs took ownership of activities, including TWG meetings and bulletin production, and PMM supported the NMCPs to implement their own activities related to SME.

Extending PMM technical programs to other health areas once PMM support ends will be beneficial for country-wide SME systems. PMM's commitment to collaboration with project country governments and implementing partners helped the project identify best practices for strengthening malaria SME systems and cultivating environments that stimulate data use for decision-making.

Appendix 1. Results

Table A1. Cross-cutting output indicators: Achievements by indicator, year, and country

Year 1	Year 2	Year 3	Year 4	Life-of-project target
Indicator: Number of functional TWGs supported by the project				
Cameroon • Cameroon Far North Regional SME TWG • Cameroon National SME TWG **Liberia** • Liberia SMEOR TWG **Sierra Leone** • Sierra Leone SME TWG **TOTAL for Y1:** **4 instances**	**Cameroon** • Cameroon North Regional SME TWG **DRC** • DRC National M&E TWG • Provincial-level malaria task forces in eight PMI-supported provinces (Haut Katanga, Haut Lomami, Kasai Oriental, Lomami, Lualaba, Sankuru, Sud Kivu, and Tanganyika) • Provincial-level M&E TWG in three PMI-supported provinces (Haut Lomami, Sankuru, and Tanganyika) **Kenya** • SMEOR COE • Quarterly Malaria SME TWG meetings held in eight PMI-supported counties (Bungoma, Busia, Homa Bay, Kakamega, Kisumu, Migori, Siaya, Vihiga) **Madagascar** • Malaria SME TWG **TOTAL for Y2:** **23 instances**	**Burundi** • National Malaria SMEOR TWG **DRC** • National-level Surveillance TWG Meeting • National-level Malaria Task Force • Provincial-level M&E TWGs in five additional PMI-supported provinces (Haut Katanga, Kasai Central, Kasai Oriental, Lomami, Sud Kivu) **Kenya** • Kenya Malaria Elimination COE **Madagascar** • Malaria SME TWG Meetings **Mali** • Malaria SME TWG **Sierra Leone** • SME Technical Working Group **TOTAL for Y3:** **12 instances**	**Côte d'Ivoire** • SME technical group **TOTAL for Y4:** **1 instance**	8–12 **TOTAL for entire project:** **40**

Year 1	Year 2	Year 3	Year 4	Life-of-project target
Indicator: Number of annual data review meeting schedules fully implemented with project support				
DRC • Quarterly health zone data review meetings **TOTAL for Y1:** **1 instance**	**Cameroon** • Bimonthly district data review meetings • Monthly regional data review meetings **DRC** • Quarterly national data review meetings **TOTAL for Y2:** **3 instances**	**Cameroon** • District data review meetings, North Region **DRC** • NMCP SME Division quarterly data review and analysis meetings • Quarterly provincial data analysis and use meetings in eight PMI-supported provinces (Haut Katanga, Kasai Central, Sud Kivu, Lualaba, Tanganyika, Haut Lomami, Kasai Oriental, Lomami) **Madagascar** • ISDR biannual data review meetings • NMCP and DVSSER monthly meetings • Malaria data discussion meetings **Mali** • Annual data review workshops in Sikasso and Kayes regions **TOTAL for Y3:** **14 instances**		32–48 **TOTAL for entire project:** **18**
Number of annual supportive supervision schedules fully implemented with project support				
	DRC • Quarterly supervision visits by the NMCP to PMI-supported provinces **TOTAL for Y2:** **1 instance**	**DRC** • Provincial supportive supervision visits • Health zone joint supervision visits **Madagascar** • Supportive supervisions at district level • ISDR activity supervisions **Niger** • Joint supervision visits in Dosso and Tahou regions **TOTAL for Y3:** **5 instances**		32–48 **TOTAL for entire project:** **6**

Year 1	Year 2	Year 3	Year 4	Life-of-project target
Number of country partner institutions that enhance their DHIS2 data collection, analysis, and/or use				
	Burundi • Burundi NMCP supported to develop and validate a malaria bulletin template to facilitate the production of standardized, well-designed, and easy-to-interpret quarterly bulletins **Cameroon** • PMM supported the NMCP to develop electronic data collection tools and M&E guidance for the 2021 SMC campaign **Côte d'Ivoire** • Development and validation of data quality verification guidelines, a monthly reporting tally sheet, and associated guidelines for recording patient information in outpatient register • NMCP configures data quality review (DQR) module in DHIS2 **DRC** • Development and dissemination of national standardized malaria data analysis guidelines **Kenya** • DNMP enhances data collection of malaria inpatient data through implementation of malaria inpatient roadmap • DNMP supported to develop and validate automated malaria emergency preparedness and response dashboard in DHIS2 to facilitate county-level assessment of and response to malaria epidemic thresholds	**Côte d'Ivoire** • NMCP configures Data Quality Review (DQR) Module in DHIS2 • Private sector report module in DHIS2 **DRC** • NMCP adapts data review guidelines for the health zone level and disseminates them to data users **Kenya** • DNMP supported to roll out EPR dashboard in DHIS2 to facilitate county-level assessment of and response to malaria epidemic thresholds **Madagascar** • Madagascar DVEP installs the COVID-19 vaccine module in DHIS2 to facilitate vaccine data reporting and management across the country **Niger** • NMCP installs WHO/GMP malaria module in DHIS2 **TOTAL for Y3:** **6 instances**		8–12 **TOTAL for entire project:** **25**

Year 1	Year 2	Year 3	Year 4	Life-of-project target
	• Malaria SME mentors supported to use the KHIS data quality tool for use in facility data quality visualization to identify and address trends in KHIS reporting **Liberia** • Liberia HMER supported to improve CBIS reporting • NMCP supported to develop new malaria reporting form for DHIS2 **Madagascar** • Development of training curriculum for the DQR application in DHIS2 • Development of a national maternal mortality surveillance protocol • Configuration and rollout of community and hospital-based DHIS2 modules **Mali** • PMM supported district staff in the Sikasso, Koulikoro, and Kayes regions to conduct monthly malaria data quality analysis using built-in DHIS2 data consistency verification tools • Revised weekly malaria surveillance data collection tools **Niger** • PMM supported Niger's NMCP to develop and validate national data assurance manual based on the MRDQA tool • NMCP installs WHO/GMP malaria module in DHIS2 **Sierra Leone** • Updated supportive supervision checklist • Malaria data dictionary **TOTAL for Y2:** **19 instances**			

Year 1	Year 2	Year 3	Year 4	Life-of-project target
Number of malaria SME champions identified by the project that complete mentorship				
		Kenya: 218		8–18
Number of training events conducted with project support				
	Cameroon • SMC data manager training, North Region • SMC data manager training, Far North Region • FETP North Region training, first cohort • FETP North Region training, second cohort • FETP ToT **Côte d'Ivoire** • National Malara SME training for national and subnational staff • Mobile dashboard and scorecard application ToT for central level staff **DRC** • COVID-19 case investigation, notification, and contact tracing training for health zone-level health professionals (Haut Katanga Province) • Malaria Management course for health zone management staff in Lomami and Kasai Central **Kenya** • National training on the MRDQA tool for DNMP, DHI, DDSR staff **Liberia** • Malaria SME ToT for NMCP and MOH staff • Malaria SME refresher training for district health officers, county data officers, malaria focal persons, and M&E officers	**Cameroon** • FETP Far North Region training, first cohort • FETP Far North Region training, second cohort • FETP Far Nort Region training, third cohort • FETP North Region training, third cohort • MRDQA training for district teams, Far North Region **Côte d'Ivoire** • Community-level data quality control (MRDQA) training • Private sector data manager training • Malaria SME training **Kenya** • Malaria surveillance mentorship training in eight PMI-supported counties (Kakamega, Busia, Siaya, Vihiga, Kisumu, Bungoma, Homa Bay, Migori) • MRDQA training for malaria SME mentors in eight PMI-supported counties (Vihiga, Siaya, Busia, Bungoma, Kakamega, Kisumu, Homa Bay, Migori) **Madagascar** • Malaria dashboard and scorecard application training in three districts (Tuléar II, Faratsiho, and Antsirable II) • Malaria SME training • DHIS2 logistics module and immunization data analysis ToT	**Cameroon** • FETP Far North training, fourth cohort • FETP Far North training, fifth cohort **Côte d'Ivoire** • National Malaria SME Course Y4 **Madagascar** • DHIS2 training for private hospital data managers • Private health facility data manager training on HIS data management and reporting • Madagascar integrated health service mobile application ToT • Madagascar Maternal and Perinatal Death Surveillance and Response (SDMPR) protocol training • Madagascar private health facility data manager training on HIS data management • DHIS2 COVAX training for district data managers **TOTAL for Y4: 9 instances**	40–60 **TOTAL for entire project: 65**

Year 1	Year 2	Year 3	Year 4	Life-of-project target
	Madagascar • National Malaria SME training for regional and district staff • ToT on DQR application for central level staff • Mobile dashboard and scorecard application ToT for central level staff **Mali** • National ToT on MRDQA tool for central level staff • Regional training on MRDQA tool in Sikasso, Koulikoro, and Kayes **Niger** • National training on MRDQA tool for central and regional staff **TOTAL for Y2:** **20 instances**	• DHIS2 logistics module and immunization data analysis tool training • DHIS2 COVAX ToT for central-level staff • Maternal and Perinatal Death Surveillance and Response (SDMPR) Training for district, regional, and IP staff in Menabe I region • DHIS2 Data Quality Tool Training for DEPSI Staff • Demographic Atlas workshop **Mali** • MRDQA training in three regions (Kayes, Segou, Bamako) **Niger** • Malaria SME training workshop **TOTAL for Y3:** **36 instances**		
Number of people trained with project support				
	Cameroon: 110 **CI:** 31 **DRC:** 106 **Kenya:** 21 **Liberia:** 181 **Madagascar:** 58 **Mali**: 97 **Niger:** 25 **Total: 629**	**Cameroon:** 127 **CI:** 78 **Kenya:** 215 **Madagascar:** 181 **Mali**: 52 **Niger**: 28 **Total 681**	**Cameroon**: 48 **CI:** 25 **Madagascar**: 474 **Total: 547**	800–1,200 **TOTAL for entire project:** **1,857**
Number of knowledge management products developed with PMI Measure Malaria support				

Year 1	Year 2	Year 3	Year 4	Life-of-project target
• DRC RHIS Architecture Profile (Published in Malaria and Health Information System Online Portal) • Monitoring and Evaluation of routine Malaria-Related Data during the COVID-19 Pandemic (Published on RBM website) • PMI Measure Malaria Website **TOTAL for Y1:** **3 instances**	• Assessing COVID-19 Infection Prevention and Control Measures Implemented During a Mass ITN Campaign in Sierra Leone (poster presentation at 2020 ASTMH meeting) • Assessing Malaria Data Reporting Accuracy in the North and Far North Regions in Cameroon: Analysis of Data from a Rapid Data Quality Assessment (Poster presentation at 2020 ASTMH meeting) • Associating the scale-up of insecticide-treated nets and use with the decline in all-cause child mortality in the Democratic Republic of Congo from 2005 to 2014 (published in Malaria Journal) • Estimating Cases of Severe Malaria at the Population Level: An Analysis of Household Surveys from 19 Malaria Endemic Countries in Africa (Presented At 2020 ASTMH Meeting) • Improvements In Malaria Data Quality and Use in the President's Malaria Initiative-Supported Provinces in the Democratic Republic of Congo from 2015 to 2019 • Management of uncomplicated malaria among children under five years at public and private sector facilities in Mali (published in BMC Public Health) • Measuring Perceived Quality of Care to Increase Utilization for Better Performance of a Malaria Surveillance System in Senegal (poster presentation at 2020 ASTMH meeting) • Monitoreo y Evaluación de Datos de Rutina Relacionados con la Malaria Durante la Pandemia COVID-19 (Published on RBM website)	• Assessing Compliance to COVID-19 Prevention and Control Measures during a Long-lasting Insecticide-Treated Net Distribution Campaign in Western Kenya (Presented at 2021 ASTMH Meeting) • Assessing trend of severe malaria cases using data from malaria commodities consumption and hospital admission records in Liberia (Presented at 2021 ASTMH meeting by PMM) • Compliance among patients/caregivers using first-line antimalarials drug (Artesunate + Amodiquine-ASAQ and Artemether + Lumefathrine-AL) in Liberia (Presented at 2021 ASTMH meeting by Liberia NMCP) • Countries and their partners improve malaria data quality in a sustainable way using the MRDQA tool (Published on PMI Measure Malaria Website) • Identifying and Addressing Gaps in the Malaria Elimination Strategy: Active Case Detection in Madagascar, 2020 (Poster presented at 2021 ASTMH annual meeting) • Improving data quality for informed decision making (Presented at 2021 USAID-STAIP Collaboration, Learning, and Adapting Conference by PMM) • Increasing Health Facilities' Access to Health Information for Decision Making and Operational Plan Development in PMI Measure Malaria Supported Districts in Madagascar (Brief published on PMI Measure Malaria Website) • Initial Assessment of the Quality of Malaria Surveillance Data in Selected Health Facilities Supported by the U.S. President's Malaria Initiative in the Democratic Republic of the Congo (Poster presented at the 2021 ASTMH annual meeting)	• Cameroon malaria surveillance assessment report technical brief • Cameroon Surveillance Assessment Report (Published on the PMI Measure Malaria Website) • Country Malaria Risk Profiling for Better Informed Malaria Control Interventions in Cameroon. (Poster presented at 2022 ASTMH annual meeting) • Dashboard and Scorecard Mobile Applications: Health Facility Adapted Decision-Making Tools to Motivate Health Providers in the Use of Their Collected Information to Monitor Health Services and Commodities (Presented at the Global Digital Health Forum 2022) • Defining Malaria Transmission Risk Profiles at the Subnational Level in Sierra Leone Using Health Facility Data (Presented at 2022 ASTMH Meeting) • DRC Malaria Surveillance Assessment Report (Published on the PMI Measure Malaria Website) • Improving Routine Malaria Data Quality Through Data Review Meetings in the Far North and North Regions of Cameroon from 2019 to 2021	15–20 **TOTAL for entire project:** **54**

Year 1	Year 2	Year 3	Year 4	Life-of-project target
	• Performance of Electronic Disease Surveillance System in Madagascar: Evidence from Comparative Study among two Clusters of Health Districts (Poster presentation at 2020 ASTMH meeting) • Rapid Identification of Gaps in Routine Health Information Systems to Strengthen Malaria Surveillance (Poster presentation at 2020 ASTMH meeting) • Routine health information system (RHIS) profile for Guinea developed and published • Routine health information system (RHIS) profile for Nigeria developed and published • Strengthening Malaria Surveillance Systems: Do We Have a Good Understanding of the Level of Investment Needed? (Presented at 2020 ASTMH meeting) • Using a Modified Challenge Model to Identify Malaria Data Issues & Improve Key Performance Indicators in Liberia (Presented at 2020 ASTMH meeting) • Using Active Case Detection to Reduce Malaria Morbidity in Hard-to-Reach Communes in Madagascar (Poster presentation at 2020 ASTMH meeting) • Utility of Reporting Presumed Malaria for Improving Malaria Case Management in Mali (Poster presentation at 2020 ASTMH meeting) **TOTAL for Y2:** **16 instances**	• Innovative Approach to Data Quality Improvement at All Levels of the Health System in Côte d'Ivoire (Poster presented at 2021 ASTMH annual meeting) • Innovative Mobile Apps for Malaria Information Access and Use at Health Facilities to Monitor Service Delivery and Commodity Management Performance in PMI Measure Malaria Supported Districts in Cote d'Ivoire (Brief published on PMI Measure Malaria Website • Lessons Learned in Malaria Surveillance (Webinar, December 2021) • MRDQA application presentation and demonstration (Presented at 2022 DHIS2 Annual Conference in Oslo, Norway) • Operationalizing Surveillance as a Malaria Intervention: Data Use for Action (Published in AJTMH Journal Supplement 1) • PMM Malaria Minute e-newsletter Issue 1 • PMM Malaria Minute e-newsletter Issue 2 • Producing a Country Malaria Risk Profile to Better Inform Malaria Control Interventions in Liberia (Presented at 2021 ASTMH meeting by PMM) • Rollout of District Health Information Software 2 (DHIS2) Implementation and Improvement of Malaria Data Quality, Analysis, and Use in Madagascar (Poster presented at 2021 ASTMH annual meeting) • Routine health information system (RHIS) profile for Malawi developed and published • Routine Healthcare Facility– and Antenatal Care–based Malaria Surveillance: Challenges and Opportunities (Published in AJTMH Journal Supplement 1) • Strengthening Malaria Surveillance through Frontline Field Epidemiology Training in the	(Poster presented at 2022 ASTMH annual meeting) • Initial Assessment of the Quality of Malaria Routine Data in Selected Health Facilities in Sierra Leone 2021 (Presented at 2022 ASTMH Meeting) • Inpatient Morbidity and Mortality: What will it take for health information systems to generate accurate information for severe malaria and malaria mortality? (Webinar, December 2022) • Malaria in Sierra Leone: Draw the Line Against Malaria (Fact Sheet for World Malaria Day 2022) **TOTAL for Y4:** **10 instances**	

Year 1	Year 2	Year 3	Year 4	Life-of-project target
		North Region of Cameroon (Poster presented at 2021 ASTMH annual meeting) • Supportive Supervision Visits to Identify Gaps in Data Management and Use at the Provincial Level in the Democratic Republic of the Congo (Poster presented at the 2021 ASTMH annual meeting) • Surveillance as a Core Intervention to Strengthen Malaria Control Programs in Moderate to High Transmission Settings (Published in AJTMH Journal Supplement 1) • Surveillance, Monitoring, and Evaluation Training Improves Practices: Results from a Follow-Up Survey of Malaria Program Staff Training, Madagascar, 2020 (Poster presented at 2021 ASTMH annual meeting) • Use of Malaria Mobile Dashboards and Scorecard Applications to Access Data at Health Facilities Has Improved Service Delivery and Commodity Management in Cote D'Ivoire and Madagascar (Brief published on PMI Measure Malaria Website) • Using Digital Technology to Improve Quality and Use of Malaria Data (Webinar, February 2022) **TOTAL for Y3:** **25 instances**		

Table A2. Intermediate outcome indicators

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
R1: Strengthened country-level capacities to collect, analyze, and use routine health data					
Number of project-supported countries that demonstrate improvement in capacities for routine health data collection and/or analysis		**DRC** • Findings from an assessment to measure the performance of DRC's COVID-19 response committees demonstrates improvements in COVID-19 surveillance and data quality review **Kenya** • Kenya's MOH adoption of the MRDQA tool as its standard for malaria data quality assurance • Kenya DNMP demonstrates increased capacity for malaria inpatient data collection and analysis **Liberia** • Liberia NMCP adopts the MRDQA as its standard for data quality assurance and independent implementation of the tool • Liberia's health facility and county-level staff advocate for improvement of malaria wall charts and their expansion to all health facilities **Madagascar** • NMCP develops standardized coaching guidance tools to improve M&E practices at the subnational level	**Cameroon** • NMCP advocates for Global Fund to implement MRDQA in non-PMI-supported regions to ensure widespread data quality assurance **Côte d'Ivoire** • NMCP independently implements MRDQA in 20 non-PMI supported districts with financial support from the Global Fund, and advocates for the Global Fund to integrate the MRDQA as a core intervention in their next round of funding **DRC** • Provincial level staff introduced and briefed on WHO/GMP malaria module, and begin using it for malaria data reviews • NMCP and DSNIS establish routine monitoring of malaria data availability and provide regular feedback to the provinces and health zones **Kenya** • DNMP engages with the Global Fund and Amref Health Africa to implement the MRDQA tool in non-PMI-supported counties **TOTAL for Y3:** **4 countries**		8–12 **TOTAL for entire project:** **8 countries**

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
		• DEPSI develops a coaching plan to verify use of DHIS2 at the subnational level **Niger** • NMCP adopts MRDQA as its standard for data quality assurance **Sierra Leone** • NMCP convenes data review meetings in Bo, Port Loko, and Kionadugu districts to improve synergy and information sharing between data users **TOTAL for Y2:** **6 countries**			
R2: Strengthened country-level capacities to manage HIS					
Number of project-supported countries that demonstrate improvements in capacities for HIS management		**Côte d'Ivoire** • NMCP develops a malaria SME plan that is aligned with the 2021–2025 national Strategic Plan and operational plan to monitor and evaluate performance indicators among all stakeholders **Kenya** • DNMP/DDSR fulfills KMS strategic objective through development of malaria elimination implementation plan, which is overseen by the Malaria Elimination COE **Madagascar** • NMCP integrates all routine malaria data into DHIS2	**Côte d'Ivoire** • NMCP operationalizes malaria SME plan at subnational level **DRC** • NMCP aligns costed leadership roadmap with 2022 annual operational plan to ensure its priority and advocates for partners and donors to support activities lacking sufficient funds **Kenya** • DNMP conducted a midterm review of the Kenya Malaria Strategy (KMS) 2019–2023 **Mali** • NMCP updates the national malaria surveillance guide to align with newly	**Madagascar** • DSFa develops MCH M&E plan • MOH demonstrates commitment to improve their HMIS system by taking over the source code, technical documentation, and training for the integrated health service mobile applications **Sierra Leone** • National malaria SME plan 2021–2025 is institutionalized at the subnational level	8–12 **TOTAL for entire project:** **6 countries**

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
		Mali • NMCP collaborates with PMM and WHO to conduct a mid-term performance review of the 2018–2022 national strategic plan • NMCP and MOH validate the revised 2021–2024 strategic plan **TOTAL for Y2:** **4 countries**	established stratification of malaria transmission risk and the WHO Global Technical Strategy **TOTAL for Y3:** **4 countries**	**TOTAL for Y4:** **2 countries**	
R3: Enhanced methods, tools, and approaches applied to address health information challenges					
Number of project-supported countries that apply a method, tool, or approach to address a health information challenge	**Liberia** • MRDQA tool implemented with NMCP **TOTAL for Y1:** **1 country**	**Burundi** • MECAT implemented with Burundi NMCP **Cameroon** • MRDQA implemented with Cameroon NMCP four times in North and Far North regions • Malaria Surveillance Assessment Toolkit implemented with Cameroon NMCP **Côte d'Ivoire** • MRDQA implemented with NMCP two times for 20 PMI-supported districts **DRC** • MRDQA implemented with NMCP and DPS 23 times in 9 PMI-supported provinces **Madagascar** • MRDQA implemented with NMCP four times in four health districts **Mali**	**Cameroon** • MRDQA implemented in North Region • MRDQA implemented in Far North Region **Côte d'Ivoire** • MRDQA implemented with NMCP in 10 PMI-supported health districts and 10 hospitals • MRDQA implemented with NMCP in 20 PMI-supported health districts **DRC** • MRDQA conducted with NMCP and DPS in 9 provinces (Kasai Central, Haut Katanga, Sud Kivu, Lualaba, Tanganyika, Haut Lomami, Kasai Oriental, Sankuru, Lomami) **Kenya** • Kenya conducts routine data quality assessments at the subcounty level using the MRDQA tool **Liberia**	**Cameroon** • MRDQA implemented to assess SMC campaign data quality in the North and Far North regions **Madagascar** • MRDQA conducted with Madagascar NMCP in four districts (Troamasina I, Troamasina II, Vangaindrano, Farafangana) **Mali** • MRDQA implemented with NMCP in five regions (Kayes, Bamako, Koulikoro, Segou, Sikasso) **TOTAL for Y4:** **3 countries**	4 **TOTAL for entire project:** **9**

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
		• MRDQA implemented three times with NMCP and the Sikasso, Koulikoro, and Kayes regional health directorates **Sierra Leone** • MRDQA implemented with NMCP in Bo district **TOTAL for Y2:** **7 countries**	• MECAT implemented in Liberia with NMCP and counties **Madagascar** • MRDQA conducted with NMCP in Atsimo Andrefana region • MRDQA conducted with NMCP in Toamasin I and II Districts **Mali** • MRDQA implemented with NMCP in five regions (Kayes, Sikasso, Bamako, Segou, Koulikoro) **Niger** • MRDQA implemented with NMCP in Tahoua region **Sierra Leone** • MRDQA implemented with NMCP in six PMI-supported districts (Bo, Koinadugu, Port-Loko, Pujehun, Western Area Rural, and West Area Urban) **TOTAL for Y3:** **9 countries**		

Table 3. Outcome indicators

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
Number of project-supported countries that demonstrate improvement in HIS data quality		**Côte d'Ivoire** • NMCP's participatory approach in implementing data verification and validation in 19 PMI-supported districts results in increased data accuracy among the assessed hospitals, rural health centers, and urban health centers **Madagascar** • DEPSI's coaching approach leads to increased timeliness and completeness of health data entered into DHIS2 by district staff between 2019 and 2020 **TOTAL for Y2:** **2 countries**	**Cameroon** • PMM and the NMCP's collaboration to implement M&E for the 2021 SMC campaign results in improved data completeness from 95.1% in 2020 to 98.8% in 2021 • PMM and the NMCP's collaboration to implement data quality assurance and review practice in the North and Far North regions leads to increased timeliness (49.6% in 2020 to 63% in 2021) and completeness (90% in 2020 to 97% in 2021) **DRC** • DRC demonstrates data quality improvement based on timeliness and completeness of national data in DHIS2 and data accuracy based on MRDQAs conducted in the 9 PMI-supported provinces **TOTAL for Y3:** **2 countries**	**Kenya** • Findings from data quality assessment reports show improvement in HIS data quality **Madagascar** • PMM support to Madagascar's NMCP leads to improvement in the quality and availability of data at health facilities in the Atsinanana region **TOTAL for Y4:** **2 countries**	8–12 **TOTAL for entire project:** **5**
Number of project-supported countries that demonstrate improvement in data use practices		**Burundi** • NMCP introduces the quarterly malaria bulletin to ensure a consistent and more timely information product to disseminate malaria data to stakeholders **Cameroon** • NMCP begins developing and disseminating SMC campaign bulletins to share information on	**Liberia** • NMCP improves information-sharing practices through ongoing dissemination of quarterly bulletins **Madagascar** • NMCP develops and validates a national data use plan **Mali**	**Madagascar** • Madagascar's national malaria bulletin is an information-sharing product that promotes regular data use **Mali** • Development of regional malaria bulletins is expanded to a sixth region (Mopti) **TOTAL for Y4:**	8–12 **TOTAL for entire project:** **6**

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
		coverage trend and stock management **Côte d'Ivoire** • NMCP institutionalizes the quarterly national malaria sentinel surveillance bulletin as an information product and mandates its distribution to stakeholders **Liberia** • NMCP's M&E team leads the development of a data demand and use training curriculum **Madagascar** • NMCP institutionalizes a coordination process to receive and review weekly surveillance data from DVSSER to improve the NMCP's access to IDSR data **TOTAL for Y2:** **5 countries**	• Development of regional malaria bulletins expands to five regions in Mali **TOTAL for Y3:** **3 countries**	**2 countries**	
Number of countries supported by PMM that have used malaria information	**Sierra Leone** • Preliminary findings from Sierra Leone COVID-19 IPC measures assessment from the first phase of its mass ITN campaign were used by NMCP and district teams to inform	**Cameroon** • NMCP used findings from 2020 SMC campaign evaluation to advocate for analysis of under-five mortality data during 2021 SMC campaign • NMCP used findings from analysis of 2010–2020 SMC data to modify 2021 SMC campaign schedule to improve coverage and effectiveness **Côte d'Ivoire**	**Cameroon** • Bangli, North Region of Cameroon reviews data to identify and address over-reporting of serious malaria among children under 5 and pregnant women **DRC** • Review of DHIS2 data on bed net and sulphadoxine-pyrimethamine coverage for pregnant women leads Tangankiya Task Force to follow up with health zone during monthly data review meetings to ensure sufficient	**Cameroon** • Analysis of 2022 SMC campaign used to inform strategy for 2023 SMC campaign • SMC technical committee uses analyses by PMM to select 9 districts in the North and Far North regions to receive a fifth round of SMC **Côte d'Ivoire** • NMCP uses malaria data to stratify districts for the 2024	8–10 **TOTAL for entire project:** **8**

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
	IPC measures for the second phase of the campaign **TOTAL for Y1: 1 country**	• NMCP uses findings from national health commodity surveys, including the Malaria Commodity Utilization Verification Survey, to update the national malaria SME curriculum to add a module on the monitoring and evaluation of logistics management • Health region and district managers use information from 2018 Performance of Routine Information System Management (PRISM) assessment and 2019 RDQA presented at September 2020 biannual malaria task force meeting **DRC** • Findings from MRDQA implementation used by DRC's Lomami Province M&E TWG to observe data collection tool stockout and to advocate for printing and distribution of updated data collection and reporting tools • Review of July–September 2020 data leads DRC's Tanganyika province staff to identify underreporting of LLIN distribution during prenatal visits and take steps to ensure supply chain availability by implementing partners and correct completion of prenatal care registers by health facility staff **Madagascar**	stocks of these commodities are available • Lomami M&E TWG uses DHIS2 data to inform updates to health facility lists for each of its 16 health zones to better inform the allocation of resources by the DSNIS and partners **Kenya** • Kisumu County TWG reviewed malaria surveillance data and convened a subcounty data review meeting to identify and resolve issues in outpatient malaria cascade • NMCP updated transmission risk map and developed county profiles using KMIS 2020 and other data, informing decision to change LLIN distribution efforts based on county transmission levels • Busia County TWG used commodity data to improve resource distribution and adherence to commodity management protocol • Kakamega County Department of Health used findings from data review meeting to make decisions to improve data quality and strengthen intervention coverage and compliance • Findings from Kenya Malaria Indicator Survey (KMIS) 2020 used to make decisions and recommendations **Niger** • NMCP uses findings of malaria quantification exercise to implement supply chain approach for malaria quantities	LLIN mass distribution campaign • NMCP uses supervision findings to update national malaria case management guidelines **Madagascar** • DSFa used built-in DHIS2 dashboard to identify, investigate, and address data quality issues **Sierra Leone** • Sierra Leone NMCP and the Expanded Program on Immunization (EPI) used this information product to inform planning of the malaria vaccine introduction in 2023 **TOTAL for Y4: 4 countries**	

Indicator	Achievements				Life-of-project target
	Year 1	Year 2	Year 3	Year 4	
		• Data review of surveillance data leads Madagascar NMCP to conduct an active case investigation in the Antsirabe II district and implement treatment and preventative measures **Mali** • NMCP uses malaria transmission stratification data by district to adjust interventions based on level of stratification **Sierra Leone** • NMCP determines the need for a malaria transmission stratification guide to inform malaria interventions for the chiefdom following PMM's presentation of district-level stratification for 2015–2020 **TOTAL for Y2:** **6 countries**	**Sierra Leone** • NMCP uses 2021 Malaria Indicator Survey data to plan for 2023 insecticide-treated net campaign **TOTAL for Y3:** **5 countries**		

Appendix 2. Project Achievements – Summary by Project Country

Burundi

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Burundi's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in August 2020, and held a country closeout meeting on April 12, 2023.[1] During the last three years, PMM has worked progressively in six PMI-supported districts (Gashoho, Kabezi, Kibuye, Nyanza-Lac, Ruyigi, and Kiremba), as well as at the central level in the National Malaria Control Program (NMCP) and Direction du système national d'information sanitaire (DSNIS).

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

SME capacity training: PMM worked with the NMCP to develop resources tailored to the Burundi specific context for the malaria M&E training workshop. The project first trained eight national-level professionals as malaria SME trainers. Based on feedback from the training and the NMCP's M&E Unit leadership's lessons from the 2021 M&E of Malaria Control Workshop in Burkina Faso, PMM organized the two-week Burundi Malaria SME workshop (13 trainees from the national and subnational levels). The training also included a field visit to conduct data quality assessment practices and evaluate the SME system's functionality at the facilities. Following the malaria SME training workshop, PMM developed a post-training follow-up plan. The plan will serve to document the use of knowledge and skills acquired by participants.

Data quality improvements: PMM conducted a desk review of existing SME documents shared by the NMCP that address data quality ("Manuel des normes et procédures de gestion du système national d'information sanitaire 2eme Edition Mars 2019" and "Plan stratégique d'amélioration de la qualité des données du système national d'information sanitaire 2019–2023"). After identifying the need for malaria-specific guidance, PMM worked with the NMCP to adapt the malaria routine data quality assessment (MRDQA) tool to the Burundi-specific context. The meeting for introducing the MRDQA tool served to discuss mechanisms for the deployment at provincial and district levels, including a proposed timeline for pilot deployment in three districts.

Routine data analysis and use through malaria bulletin development: Previously, the National Epidemiological Bulletin only summarized malaria cases in a short section. PMM supported the NMCP in developing a template for a specific quarterly malaria bulletin that addresses many malaria indicators. Since its first issue in the last quarter of 2020, PMM has supported the NMCP and the DSNIS to produce nine malaria bulletins. The bulletin informed on the completeness and timeliness of reporting, number of cases, prevention activities in pregnancy, case management, and supplies management. It also reported specific malaria activities across the country. Over the quarters, the NMCP enhanced its ownership of the process, and the program has acquired technical autonomy in producing quality bulletins that now include geographical analysis presenting regional variation of malaria-related indicators.

Secondary analysis of weekly malaria surveillance data: The analysis was performed in response to the increased number of malaria cases over successive weeks in 2022. A time trend analysis identified the significant increase in malaria cases and illustrated how routine data helped the team identify a malaria outbreak or possible data quality issues.

[1] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

Result 2: Improved country-level capacities to manage the health information systems

MECAT assessment and capacity strengthening: PMM supported the NMCP's monitoring and evaluation capacity needs assessment using the Monitoring and Evaluation Capacity Assessment Tool (MECAT). The assessment consisted of an evaluation with the NMCP staff and malaria focal points from 13 health districts, informant interviews with key malaria stakeholders, and a desk review of the program's strategic and M&E reference documents. Findings from the evaluation were used to determine priority actions and develop a plan for strengthening the Burundi NMCP's SME capacity. Some of the priority actions were integrated into the program's malaria M&E Strategic Plan 2023–2027.

Strengthening the coordination of malaria SME: PMM supported the NMCP to make the malaria SME and operational research technical working group functional at the central level. At the quarterly meetings, stakeholders discussed critical malaria M&E and operational research topics, explored challenges, and made recommendations to improve SME practices.

Integration of malaria data into the DHIS2: To streamline data use, the project has planned to install the WHO/GMP malaria module in the DHIS2 platform. PMM, with NMCP and the DSNIS, developed a concept note clarifying the process. PMM received feedback that should serve to define and tailor the content of the planned operation.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Supervision tools: In addition to the development of a package for the Malaria SME workshop, PMM supported the NMCP in developing integrated malaria supervision tools. The tools address vital tasks that help streamline supportive supervision activities at all health system levels.

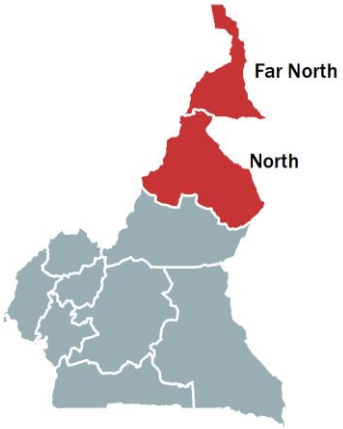
Challenges and Lessons Learned

- National and subnational-level professionals have shown great interest and enthusiasm for the MECAT assessment, malaria SME training, and developing an M&E plan. Strengthening data quality and use remains a critical need across the system, and the NMCP and partners expect a lot from the further deployment of the MRDQA tool.
- Due to the limited direct technical assistance and interaction in fields, the model of PMM's remote technical support to the NMCP, even combined with short in-country visits, was shown to be of limited effectiveness for the uninterrupted technical assistance the project was expected to provide. Such assistance better worked with the presence of a resident expert working full-time with the NMCP to identify and respond to the program's needs in real time. This challenge was significantly related to the COVID-19 pandemic, and it caused delays and ineffectiveness in project implementations.
- The malaria quarterly bulletin production process has gradually and substantially enhanced data analysis and use within the NMCP. The project team expects the continued production and dissemination of the malaria quarterly bulletins.
- Although some of the production processes worked to strengthen data use, a significant reporting burden and limited technical autonomy were reported. The production of documents required too many steps, especially when the process asked the NMCP to submit concept notes/terms of reference to PMM, develop drafts, and validate documents. This intensive commitment requirement also resulted in NMCP calendar conflicts, especially since the program worked with a limited number of M&E technical staff.
- Though the M&E operational research technical working group met regularly, it remained insufficiently oriented toward SMEs. Most of the themes addressed during the meetings are operational research focused. More SME focus-driven preparation should be considered.

Cameroon

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Cameroon's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in May 2020, and held a country closeout meeting on October 3, 2023.[2] During the last three and half years, PMM has worked progressively in 47 health districts in two PMI supported regions of Extreme-Nord and Nord RDPH, as well as at the central level in the National Malaria Control Program (NMCP) and the Direction de Lutte contre les Maladies, les Epidémies et les Pandémies (DLMEP).



PMI-supported regions

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Regional malaria SME trainings: In Years 2 and 3, PMM supported the Direction de Lutte contre les Maladies, les Epidémies et les Pandémies to organize five cohorts of Field Epidemiology and Laboratory Training Program (FETP) in the Far North Region and three cohorts in the North Region. FETP training aimed to improve best practices in malaria surveillance. One hundred and ninety participants underwent a 12-week training with a one-week onsite training followed by fieldwork. It helped trainees understand the importance of data quality and how to apply training content to improve their work. During fieldwork, trainees worked with health facilities to follow up to ensure that the recommendations were implemented. Giving participants applied experience with data and emphasizing the importance of data quality at the facility level helps improve data quality at the local level.

Streamlined seasonal malaria chemoprevention: In Cameroon, the NMCP has demonstrated data-informed decision-making for its annual Seasonal Malaria Chemoprevention (SMC) campaign. In Year 1 of PMM, the project supported the implementation of the 2020 SMC campaign, specifically the coordination of M&E of the campaign as well as follow-up and evaluation workshops. In Years 2 and 3, PMM continued to support the implementation of the 2021 and 2022 SMC campaigns in 452 health areas, including evaluation workshops. The evaluation analysis findings led to changes in SMC implementation strategies, including timings (e.g., 31 out of 47 health districts started SMC in June 2023, as opposed to July, before the first peaks of malaria transmission. Fourteen districts conducted the campaign in five cycles rather than four cycles.) Use of malaria data to inform the annual SMC campaign strategy demonstrated the NMCP using data to inform their decision-making for a critical recurring malaria program.

Improved data quality and assurance practices: PMM established routine data quality assurance practices embedded into SMC planning by using malaria data quality assessments (MRDQAs) tools. The first round was conducted in July 2021 to assess the quality of data reported through DHIS2 for 188 health facilities compared to data in registers and forms. It continued up to the fourth round in Year 4 in two PMM regions. The efforts resulted in improved data timeliness (49.6% in 2020 to 63% in 2021) and completeness (90% in 2020 to 97% in 2021).

Improved data use and dissemination: By utilizing strengthened malaria HIS, PMM supported NMCP and region leaders in publishing malaria bulletins from Year 2, 34 SMC campaign bulletins at the regional level successfully documented information on coverage trend and stock management. Twenty-one malaria bulletins (2 at the national level, 19 at the regional level) effectively tracked evidence for decision-making and helped keep track of program performance. At international levels, PMM supported the preparation of six poster presentations at the American

[2] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

Society of Tropical Medicine and Hygiene annual meetings.[3] Those opportunities offered a place for all stakeholders involved in malaria control to share in-country evidence.

Result 2: Improved country-level capacities to manage the health information systems

Developed key strategic documents: PMM supported NMCP in developing strategic planning, provided roadmaps for the program, built institutional memory, and supported accountability. The key published materials included: Malaria National Strategic Plan (2019–2023; 2024–2028), LQAS-Based SMC External Monitoring Protocol (2022), Protocol for Malaria Data Review and Validation Meetings, and data analysis and visualization protocol.

Improved stakeholder coordination: To enable effective coordination among malaria stakeholders, PMM convened semi-annual National SME technical working groups and quarterly regional technical working groups in Far North and North PMM regions between Year 1 and Year 4.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Piloted malaria wall charts at facility level: To foster a culture of data review and support data review meetings at the facility level, PMM piloted the malaria wall charts project in 35 health facilities in the North and Far North regions. It provided opportunities for facility staff to review and analyze their data monthly and plot the performance of key indicators.

Challenges and Lessons Learned

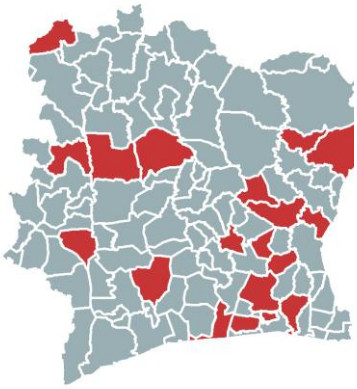
- Limited governance and guidance documents in malaria SME hampered quick implementation of the project, especially in Year 1 and 2. There was no nationally mandated surveillance guidance, limited operationalization of its data use plan, no data use curriculum, and limited identification of data needs within the NMCP. Preparing key guidance materials could support ownership of SME activities and its effective implementations.
- Limited human resources in NMCP in malaria SME activities were continuously threats to effective program implementations. Challenges were due to time conflicts, security concerns, and COVID-19 pandemic restrictions on in-person gatherings.

[3] "Performance of Electronic Disease Surveillance System in Madagascar: Evidence from Comparative Study among two Clusters of Health Districts (2020)," "Country Malaria Risk Profiling for Better Informed Malaria Control Interventions in Cameroon," "Improving Routine Malaria Data Quality Through Data Review Meetings in the Far North and North Regions of Cameroon from 2019 to 2021 (2022)," and "Strengthening Malaria Surveillance through Frontline Field Epidemiology Training in the North Region of Cameroon."

Côte d'Ivoire

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Côte d'Ivoire's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in April 2020, and held a country closeout meeting on April 12, 2023.[4] During the last three years, PMM has worked progressively in 21 PMI supported districts (Agboville, Agnibilekrou, Akoupe, Alepe, Anyama, Bondoukou, Bongouanou, Dabou, Daoukro, Dimbokro, Duekoue, Gagnoa 1, Grand-Bassam, Grand-Lahou, Mankono, Mbahiakro, Minignan, Nassian, Port Bouet Vridi, Seguela, and Touba), as well as at the central level in the National Malaria Control Program (NMCP).



PMI-supported districts:

Agboville	Gagnoa 1
Agnibilekrou	Grand-Bassam
Akoupe	Grand-Lahou
Alepe	Mankono
Anyama	Mbahiakro
Bondoukou	Minignan
Bongouanou	Nassian
Dabou	Port Bouet Vridi
Daoukro	Seguela
Dimbokro	Touba
Duekoue	

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Improved data quality assurance and malaria bulletins: PMM conducted HIS assessment in 2019 using the Performance of Routine Information System Management (PRISM) and data quality assessment twice in 2020 using malaria data quality assessments (MRDQAs) tools. Following that, PMM supported the NMCP in developing their 2021–2025 national SME plan, which mandates disseminating validated malaria program data to inform stakeholders of the status of malaria activities, identify problems, and propose collective actions. The SME plan thereby institutionalized the quarterly sentinel surveillance bulletin as a national information product. The NMCP engaged malaria stakeholders in quarterly data reviews to address quality issues and data analysis to monitor and discuss performance indicator trends. The NMCP then worked with PMM to develop the bulletin and present key findings to malaria program managers at different levels of the health system.

Improved data-driven approach in LLIN campaigns: PMM supported the NMCP to use data to improve planning for the 2024 lasting insecticidal nets (LLIN) mass distribution campaign. Previously, the NMCP prepared the campaigns by using health district-stratified malaria data. However, after the 2021 campaign, the NMCP received feedback from the districts that indicated that the distribution campaign was not producing the expected reduction in malaria. The NMCP used skills in data analysis acquired through PMM support to revisit the stratification analysis. Upon re-analysis, the NMCP and partners determined that only 24 health districts could still use previous-generation LLINs, and 89 districts now required next-generation LLINs to address insecticide-resistant mosquitos. Planning for the 2024 campaign is ongoing based on this information. The response to district feedback and use of multiple data sources demonstrated the NMCP's continuing commitment and ability to use data for program decision-making.

Updating malaria case management guidelines: PMM supported the NMCP conducting joint supervision visits to check data accuracy in select districts and health facilities. The visits found that providers frequently misunderstood the indicators' definitions and modes of calculations. PMM then assisted the NMCP in developing supervision reports highlighting gaps and proposed solutions to the identified problems. Suggested actions included on-site orientation sessions during supervision visits on understanding indicators, national malaria management guidelines, and correct filing of data collection tools. In March 2022, in Yamoussoukro, the NMCP held a validation workshop and updated the malaria case management guidelines in response to the joint supervision visit findings.

[4] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

Result 2: Improved country-level capacities to manage the health information systems

Mobile dashboard and scorecard app improved data use capacity: PMM, in collaboration with the NMCP, evaluated the use of scorecard and dashboard applications and decision-making mechanisms in eight health districts in 2023. Evaluation findings showed that regular use of mobile apps increased over time among trained healthcare providers at the facility level, from 50% at baseline to 75%. Providers also reported that data visualization elements in the applications were informative and easy to use. Ninety percent of health providers said the graphs are appropriate, clear, concise, and usable for decision-making. Additionally, healthcare providers on the sites stated that regular use of the scorecard and dashboard mobile applications positively impacted the quality of healthcare offered to patients. The performance of RDTs, according to the current national protocol, has improved by 21% compared with the baseline assessment.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Practical tools for malaria data validation: PMM collaborated with the NMCP to develop data verification and aggregation tools and data element completeness guidelines to facilitate health facilities to better prepare monthly reports and avoid data aggregation errors and duplication. The data aggregation guideline enables weekly intermediate counting in tally sheets. Following the health facility support, PMM worked with NMCP and other partners to mentor regional and district teams on data verification and validation at the health facility level to prepare the monthly report. The third technical approach was to strengthen supervisors' capacity to use MRDQA and routine data quality assessment tools and to conduct joint supervision led by the NMCP. As a result of this approach, between August 2020 and March 2021, data accuracy among the 57 assessed hospitals, rural health centers, and urban health centers considerably improved for the selected indicators from an average of 30% to approximately 60%.

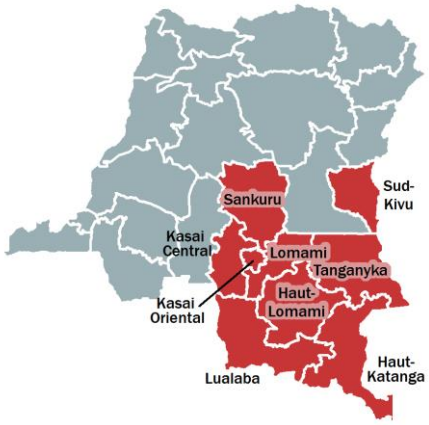
Challenges and Lessons Learned

- Limited data ownership of key SME personnel brought challenges in Years 1 and 2. The project reported limited ownership of data quality control by the data producer at the operational level and limited accessibility of DHIS2 data by malaria key stakeholders. Those limitations hampered the consistent use of data for decision-making.
- Integration of the private sector into the malaria reporting system was challenging. HIS should be designed to cover a comprehensive health delivery system to monitor critical indicators effectively.
- SME human resources within NMCP should be invested in and secured more. The NMCP staff's unavailability during the preparation and ramp-up of the LLIN distribution campaign caused delays in some activities—including data quality assessments, stakeholder meetings, and malaria bulletin production.

Democratic Republic of the Congo

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support the Democratic Republic of the Congo (DRC)'s efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in October 2019, and held a country closeout meeting on March 22, 2023.[5] During the last three and half years, PMM has worked progressively in 179 health zones in 9 PMI-supported provinces (Haut Katanga, Haut Lomami, Kasai Central, Kasai Oriental, Lualaba, Lomami, Sankuru, Sud Kivu, and Tanganyika), as well as at the central level in the National Malaria Control Program (NMCP).



PMI-supported provinces

Key Achievements

Result 1: Strengthened country-level capacities to collect, analyze, and use routine health data

Improved data analysis practices: PMM technically and financially supported the NMCP in convening monthly and quarterly malaria data analysis meetings at the national and provincial levels. After identifying the data quality gap at the baseline, the meetings contributed to holding feedback opportunities and improving data accuracy. PMM also supported the NMCP in organizing a malaria management course for 76 health zone coordinators, 12 staff members from the NMCP/provincial health division, and three provincial SME advisors to ensure effective management of malaria control activities. As a result of the combined technical capacity-building activities, the project observed good completeness of data for the whole country (98%), good timeliness (90%) of data, and the availability of tools in Year 4.

Improved data quality assurance practices: Through the implementation of the Malaria Information Index and the Malaria Routine Data Quality Assessment (MRDQA) tool in the baseline of Year 1, PMM identified the needs and provided support to monitor DHIS2 functionality at the provincial level through reviewing the availability of data collection tools and assessing information technology capacity. Provision of data collection tools and workshops, supervision visits on the functionality of DHIS2 at the provincial level, and the development of the malaria data dictionary facilitated the routine data quality assessment with the MRDQA tool in each province. The assessments focused on reporting performance as well as system evaluation. PMM facilitated the endline quality assessment in Year 4, and the project confirmed the improved availability of standard reports, with improvement in data availability (>90% in Year 4 compared to >50% in Year 1). Furthermore, the system's progress resulted in improved data quality; the number of data quality rules violated in DHIS2 in 9 PMM provinces reduced from an average of 14.1 (violations) in Year 2 to 3.1 in Year 4.

Improved use and dissemination of data: Continued technical advising resulted in the successful development and dissemination of national/provincial quarterly malaria bulletins, as well as NMCP annual reports. Key findings from those reports were also presented at national/international opportunities, including World Malaria Day celebrations (2021, 2022), Malaria Scientific Days (2021, Lubumbashi), and poster presentations at ASTMH annual meetings (2020, 2021, 2022).[6]

[5] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

[6] "Improvement in Malaria Data Quality and Use in the President's Malaria Initiative Supported Provinces in the Democratic Republic of Congo from 2015. to 2019" (2020), "Supportive Supervision Visits to Identify Gaps in Data Management and Use at the Provincial Level in the Democratic Republic of the Congo" (2021), "Initial Assessment of the Quality of Malaria Surveillance Data in Selected Health Facilities Supported by the U.S. President's Malaria Initiative in the Democratic Republic of the Congo" (2022), and "Supportive Supervision Visits to Identify Gaps in Data Management and Use at the Provincial Level in the Democratic Republic of the Congo" (2022).

Result 2: Improved country-level capacities to manage the health information systems

Improved coordination and leadership: PMM supported the NMCP to revitalize and organize 10 Monitoring and Evaluation Technical Working Group (TWG) meetings, 10 Malaria Task Force meetings, and eight surveillance TWG meetings from Year 2 to Year 4. The continued stakeholder meetings worked as a place to accelerate partner coordination at various levels of decision-making, from the health zone to the international level. Their co-leadership ensured synergy in the implementation of activities, enabling effective progress. PMM also supported the NMCP in developing a leadership development self-assessment protocol, the National Strategic Plan, and the Global Fund concept note in Year 4 to ensure its priority and effective advocates and to sustain the positive change in leadership development.

Improved DHIS2 functionality: All nine provinces established monitoring practices and feedback loops on DHIS2 functionality. After identifying the shortage of standardized reporting tools, PMM provided the 179 health zones with data collection and reporting tools and supported effective data entry practices.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Institutionalized tools for measuring data quality: The MRDQA tool helped to implement routine progress monitoring and supervision visits in an institutionalized way at the national and provincial levels.

Measuring surveillance system performance: Working in collaboration with PATH and CHAI, PMM developed an assessment framework and conducted the capability assessment of the larger surveillance system. A roadmap for the country was developed and used during the development of the National Strategic Plan 2024–2028 and the Global Fund concept note.

Innovative tools for improving reporting: PMM explored the use of innovative digital technology, an automated RDT reader, to improve the quality of malaria surveillance data at the facility level. The cross-validation analysis on test positivity rates between what was measured by RDT readers and what was reported in traditional registers identified inconsistency and revealed the gap to improve data quality. PMM also observed that the introduction of new digital tools might change attitudes toward willingness to conduct Malaria tests at health facilities.

Improving indicator denominators: PMM supported the NMCP in developing indicators of population access to malaria diagnosis and treatment to better understand target population sizes in denominators and improve interpretation of surveillance data. The Shiny app was developed for data visualization in collaboration with international partners, primarily the Malaria Atlas Project, to develop high-resolution surface modeling to improve accuracy of populations data.

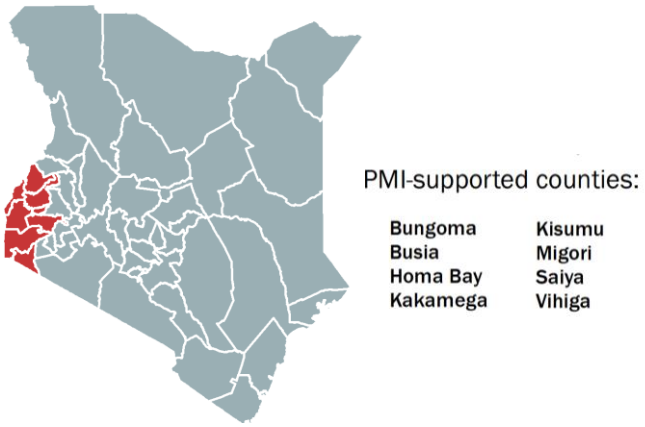
Challenges and Lessons Learned

- Given the negative consequence of the recent COVID-19 pandemic on the project implementation, a development of SME system resilience to emerging threats, such as pandemic, disasters, insecurity, should be encouraged more. PMM provided technical support/training to strengthen SME components of the COVID-19 response, and documentation of lessons learned to Health Information Management Committee. COVID-19 has also enabled the improvement of online activities. However, inclusiveness for healthcare providers with limited access to the internet should be addressed.
- Transition from paper-based reporting to digital data collection, especially at health facility levels, is needed to further improve reporting effectiveness and quality.
- Community health workers can be leveraged more to achieve an effective malaria surveillance system at community and subnational levels.
- Extension of technical assistants to 17 non-PMI provinces (out of 26 total) should be considered.
- Strong ownership by NMCP in SME collaboration activities was a key driver to the project's successes.
- Technical support at the provincial level enabled the project's operations. Data quality can only improve if local data producers understand its importance.

Kenya

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support the Kenya's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in January 2020, and held a country closeout meeting on July 11, 2023.[7] The project began with support to the Division of National Malaria Program (DNMP) in Year 1 and expanded to include support to the eight lake endemic counties (Bungoma, Busia, Homabay, Kakamega, Kisumu, Migori, Siaya, and Vihiga) in Years 2 and 3. Through support to the DNMP, PMM's work also extended to 26 epidemic-prone counties and supported DNMPs preparatory work of establishing structures for malaria elimination in four low-risk counties (Kirinyaga, Laikipia, Nyandarua, and Nyeri).



Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Improved malaria SME capacity through mentorship: PMM developed the malaria SME mentorship package, including the protocol, training materials, and mentorship digital checklist to address capacity challenges. From Year 2 to Year 4, the project supported the 215 mentors to provide hands-on data quality improvement support to health facilities using the malaria routine data quality assessments (MRDQA) tool and achieved 95% coverage of target facilities (2,760 mentorship visits in 1,252 health facilities). The trained mentors played a key role in routine data review meetings and became champions of data quality improvement efforts at the subnational level.

Improved data quality: PMM defined the protocol for data quality assessment and provided technical and logistic support to conduct three rounds of MRDQA assessments at 610 health facilities in the lake-endemic region. In Year 4, more than three-quarters of the health facilities met the target quality threshold for suspected malaria (79%), tested for malaria (78%), and confirmed malaria (80%). Data accuracy scores for all five indicators of interest (suspected malaria, tested for malaria, tested using malaria rapid diagnostic test/microscopy, and number of pregnant women receiving three doses of intermittent preventive treatment in pregnancy) improved significantly from Year 2 to Year 4 (verification factor: 90–110).

Improved availability of malaria inpatient data: PMM strengthened the availability of malaria inpatient data by implementing the roadmap, increasing capacity for ICD11 reporting, routine data review, and developing the national inpatient discharge summary tool. As a result, the proportion of health facilities reporting malaria inpatient data increased from 28% in 2018 to 51% in 2020.

Improved data use to inform malaria programming and policy: PMM provided support to update the national malaria transmission risk map and county malaria epidemiological and control profiles in Year 2. The products effectively informed the Mid-Term Review of the Kenya Malaria Strategy (KMS) (2019–2023). In Year 2, PMM supported the dissemination of the malaria profiles and the KMS to all 47 counties and convened the fourth Kenya National Malaria Forum that provided a platform for information exchange among researchers, partners, and governments in malaria control (253 participants). Key findings were also presented at ASTMH annual meetings.[8]

[7] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

[8] "Assessing Compliance to COVID-19 Prevention and Control Measures during a Long-Lasting Insecticide- Treated Net Distribution Campaign in Western Kenya (2021)" and "Monitoring the quality of Malaria Surveillance data in select endemic counties in Kenya (2022)."

Result 2: Improved country-level capacities to manage the health information systems

Developed a guideline and modules: PMM supported the development of the first edition of the Kenya Malaria Surveillance guideline and the malaria module in DHIS2 (in collaboration with the University of Nairobi-Health IT project). The standardized guideline and tools enabled effective surveillance across the different epidemiologic zones in Kenya.

Improved malaria stakeholder coordination: PMM revitalized malaria technical working group (TWG) meetings in the lake endemic counties at least three times per year between Year 2 and 4 and promoted the participation of the PMI implementing partners in data review meetings. Having a platform to discuss progress and action plans with multi-levels malaria stakeholders helped the project with efficient implementation.

Supported the establishment of systems for malaria elimination: Following the launch of the KMS (2019–2023), PMM led the development of the Kenya Malaria Elimination Implementation Plan (2021–2023) to outline national strategy towards Malaria elimination. In collaboration with WHO, PMM supported the DNMP to convene the malaria elimination committee and supported the assessment of the counties' operational preparedness to implement malaria elimination activities.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Automated malaria epidemic monitoring: In collaboration with the University of Nairobi Health IT project, PMM supported the development of the Epidemic Preparedness and Response dashboard and migration from manual to automated monitoring of malaria epidemic thresholds. The new dashboard was rolled out in all 26 epidemic-prone counties, and it allows users to identify and respond to malaria outbreaks.

Developed job aids for malaria data reporting: After MRDQA identified the data quality gap in the lack of knowledge among health workers and the filling of registers by non-technical staff, including casual workers who are often not sensitized on proper documentation, PMM supported the DNMP to develop job aids for data reporting. The job aids were disseminated to all health facilities and the sub-county teams in the lake endemic region. Combined with the mentorship program and routine data analysis meetings, it facilitated improved data quality at the facility level.

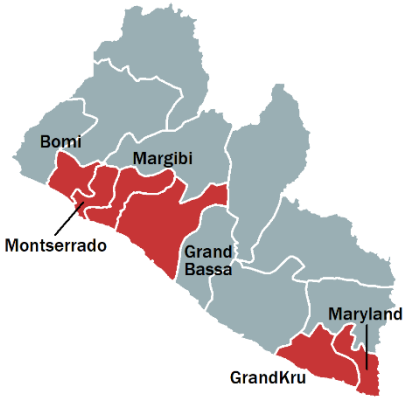
Challenges and Lessons Learned

- Malaria SME strengthening efforts are best focused at the sub-county level. Sub-counties are smaller administrative units and hence, SME strengthening initiatives can be more readily cascaded to the health facility level.
- Capacity building in malaria SME human resources at subnational/county level should be invested more. Rational transfer of staff by counties could be helpful to promote their utilization in strengthening their SME capacities. Shifting documentation roles to data clerks and community health volunteers worked as a temporary measure to address the gaps in human resources. However, this did not eliminate the need for a skilled workforce, particularly in the lower-level health facilities, to efficiently handle documentation and reporting responsibilities.
- The mentorship approach was a cost-effective way of transferring knowledge to a large pool of health workers. It also provided a mechanism to track the efforts on data quality improvement. These achievements should be leveraged in non-PMI-funded counties.
- Digital technologies for data capture, reporting, and analysis should be adopted to overcome the perennial challenge of inadequate HIS tools and increased demand for malaria inpatient data. Throughout PMM activities, the use of multiple automated dashboards was efficient for promoting data use up to the facility level.
- Country leadership for the development and accreditation of standards for electronic medical records is critical to ensure interoperability between new digital tools and DHIS2.
- The malaria program's ownership of SME efforts is vital for successful implementation. PMM focused on collaboration with the DNMP and county departments of health and supported the malaria program's leadership role.

Liberia

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Liberia's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in April 2020, and held a country closeout meeting on March 31, 2023.[9] Throughout the project time, PMM worked closely with the Liberia National Malaria Control Program (NMCP) and Health Information Systems, Monitoring, and Evaluation and Research (HMER) Department.



PMI-supported counties

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Malaria surveillance curriculum: From 2022, PMM supported HMER in developing a malaria surveillance curriculum and worked with the NMCP M&E team to prepare the malaria SME workshop. PMM attended the workshop in Ganta, Nimba County, chaired most of the working sessions, and made a presentation on surveillance guidelines and activities. The training built the capacity to use malaria data to make health system decisions by creating demand for quality data for decision-making, improving data producers' and decision-makers understanding of the use of data in decision-making, and refreshing data staff on navigating DHIS2 to download, analyze, interpret, and present data.

Result 2: Improved country-level capacities to manage the health information systems

Demonstrated increased independence in malaria bulletin production: Through technical support in SME activities and improved stakeholder coordination with Surveillance, Monitoring, Evaluation, and Operational Research technical working groups established in Year 1, PMM supported the NMCP's ownership in developing malaria quarterly bulletins. By Year 3, PMM transitioned the production of the quarterly malaria bulletin to the NMCP. In 2021, the NMCP took on a leadership role in developing the bulletin, including data analysis, extracting, and writing with limited support from PMM. Throughout 2021, the NMCP developed all malaria bulletins, with PMM only providing final review and editing. The staff of the SME Unit were involved in each step of the process in the past few years, aiding the transition to full ownership of the malaria bulletin development process by the NMCP. The malaria bulletin is disseminated among the NMCP senior management and malaria partners in the country, allowing the NMCP to share progress, achievements, and challenges and to aid in informed decision-making at the central levels. The NMCP and other stakeholders have used the malaria bulletin to better understand the geographical burden of malaria in the country and which counties should be targeted with malaria intervention resources.

International dissemination: In addition to the successful dissemination of malaria data with bulletins at the national level, PMM supported the preparation of poster presentations at the American Society of Tropical Medicine and Hygiene annual meetings.[10] Those opportunities offered a place for all stakeholders at the international level involved in malaria control to share in-country evidence.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Monitoring and Evaluation Capacity Assessment Toolkit (MECAT): PMM supported Liberia's NMCP to implement MECAT nationally and with 15 county health teams. The objectives of the survey were to determine SME capacity at all levels of the health system and understand

[9] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023

[10] "Producing a Country Malaria Risk Profile to Better Inform Malaria Control Interventions in Liberia (2021)," " Using a Modified Challenge Model to Identify Malaria Data Issues & Improve Key Performance Indicators in Liberia (2020)."

current performance objectives and gaps to determine the most appropriate interventions to monitor and evaluate success in malaria SME capacity strengthening. The national MECAT found that good quality tools, structures, and standard operating procedures have been established for most routine activities; however, the assessment found weaknesses in overall data demand and use, technical and financial autonomy, and human capacity for M&E. Findings were used to help identify priorities and next steps for capacity building for the NMCP.

Challenges and Lessons Learned

- The lack of an annual consolidated work plan led to competing priorities at the time of implementing field activities and even sometimes to duplicating activities.
- Capacity assessment at the baseline level was critical to inform the planned project strategies. Initial capacity for M&E, especially for county-level M&E managers, was low. Thus, the project had to spend time on the basics of M&E before moving to focus on the Malaria SME that it was designed to address. DHIS2 access, navigation, and use capacity are different and thus affect the ability to download, analyze, and use data for decision-making.
- Logistical challenges with the country terrain, thus the far-to-reach counties, had added difficulty with reporting and conducting support supervisor and mentorship activities. Montserrado County, which has the capital center, benefited from more support and mentorship, although it also has most facilities.
- The COVID-19 pandemic has ushered in a new working paradigm with virtual meetings and working sessions. For field implementation of the activities that required physical or in-person meetings, this translated into multiple working sessions to practice social distancing and extra costs to cope with other COVID-19-related preventive measures.

Republic of Madagascar

PMI-supported regions

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Madagascar's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in March 2020, and held a country closeout meeting on June 22, 2023.[11] In collaboration with the National Malaria Control Program (NMCP), PMM facilitated activities within the Direction de la Veille Sanitaire, de la Surveillance Épidémiologique et Riposte (DVSSER), the Direction des Etudes, de la Planification et du Système d'Information, the Direction de la Santé Familiale, and the Direction du Programme Elargi de Vaccination. The subnational supervision activities were operated in 10 health regions in Madagascar (Alaotra Mangoro, Boeny, Vakinankaratra, Atsinanana, Atsimo Andrefana, Itasy, Analamanga, Analandjirofo, Menabe, and Atsimo Atsinanana).

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Improved data quality assurance practices: At national level, PMM supported the NMCP to organize 12 quarterly malaria data discussion meetings to review data submitted by health districts and compiled quarterly by the NMCP SME unit, identify data quality issues, and find solutions to address them. Through continuous efforts, monthly malaria reporting completeness remained good (from 94% in 2018 to 97% in 2023), and timeliness was significantly improved (from 46% in 2018 to 92% in 2023).

At subnational level, PMM supported the training of 251 regional and district data managers and mentored them to discuss data quality issues during quarterly and semiannual regional coordination meetings. PMM also provided technical support to the NMCP to conduct three rounds of malaria routine data quality assessments (MRDQAs) in selected five regional districts. The desk review of data helped supervisors provide feedback to health facilities on the quality of the data and on their level of service delivery and commodity management performance, which enabled them to seek solutions to address and improve their indicator outputs and outcomes. The proportion of submitted reports without missing data in selected five districts enhanced from 70% in 2021 to 86% in 2023.

After identifying districts with critical data quality gaps, PMM supported 45 supportive supervision visits and 1,056 coaching sessions. It trained 19 coaches from multiple NMCP divisions, facilitated timely support to address data quality issues, and built an effective feedback loop.

Improved use and dissemination of data: PMM contributed to various key material developments throughout the project time. By analyzing malaria indicators stored in DHIS2, the team compiled and disseminated 21 quarterly malaria bulletins and about 50 monthly integrated disease surveillance and response bulletins. Between 2020 and December 2022, PMM supported the NMCP in organizing three national scientific malaria conferences. At the international level, PMM supported preparing poster presentations at the American Society of Tropical Medicine and Hygiene annual meetings.[12] Those opportunities offered a place for all stakeholders involved in malaria control to share in-country evidence.

[11] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

[12] "Performance of Electronic Disease Surveillance System in Madagascar: Evidence from Comparative Study among two Clusters of Health Districts." (2020)", "Using Active Case Detection to Reduce Malaria Morbidity in Hard-to-Reach Communes in Madagascar (2020)", "Identifying and Addressing Gaps in the Malaria Elimination Strategy: Active Case Detection in Madagascar (2021)", "Rollout of District Health Information Software 2 (DHIS2) Implementation and Improvement of Malaria Data Quality, Analysis, and Use in Madagascar (2021)," and "Surveillance, Monitoring, and Evaluation Training Improves Practices: Results from a Follow-Up Survey of Malaria Program Staff Training, Madagascar (2021)."

Result 2: Improved country-level capacities to manage the health information systems

Improved staff capacity in SME: By adapting malaria training curricula and coaching guidelines, PMM trained 370 malaria data managers, 1,715 HIS program officers, and 427 private health facility data managers to improve their data entry/management capacity. The project conducted a follow-up survey in 2021 to assess 30 selected trainees' knowledge and practices regarding SME activities six months after the last SME training. The survey found that 67% of the respondents found the training relevant to their daily activities, 83% had the skills to develop the strategic and M&E plans, and 100% were involved in developing their respective district plans.

Developed key strategic plans: To identify progress and challenges in implementing the malaria strategic plan, PMM supported the malaria annual plan review process from 2020 to 2023. It found that 76% of activities planned in the strategic plan 2018–2022 were partially implemented, and 40% were fully implemented. By utilizing the lesson learned and participatory approach among key NMCP teams and implementing partners, PMM supported the NMCP in developing national malaria strategic plan 2023–2027, including the M&E plan.

Improved coordination of SME activities: Between April 2020 and June 2023, PMM provided technical and logistical support to the NMCP to organize the malaria SME monthly technical working group meetings (47 meetings). The project also supported DVSSER in organizing biannual integrated disease surveillance and response workshops (594 participants), and quarterly malaria data harmonization meetings between DVSSER and the NMCP. This stakeholder coordination helped to update key stakeholders on malaria epidemiological trends and enabled M&E integration across different malaria data sources.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Updated key governance and guidance documents: PMM facilitated updating key SME guidance materials. The validated malaria data use plan outlined the scope of work and tasks of each entity or level of the health system that uses malaria data and enabled activities implementations. In collaboration with partners, the project reviewed and updated: guidelines for maternal and perinatal death surveillance and response, community and hospital DHIS2 module rollout plan, private health sector data integration action plan, etc. Those materials supported the HIS department to improve the DHIS2 platform and tool integrations.

Mobile malaria and integrated health service dashboard: PMM developed and implemented mobile malaria and integrated health service dashboard and scorecard apps to increase real-time data access, analysis, and use at the subnational level. The project supported the integration of monthly report forms at hospital and community sites as well as private health facility data into DHIS2, which led to comprehensive data collection. The institutionalization of new applications during the district-level quarterly meetings led to the sustainability of data reviews at the subnational level.

Challenges and Lessons Learned

- The COVID-19 pandemic impacted the health services delivery to the population in need. Through support from PMM, the Malagasy people showed resilience against COVID-19, which enabled the deployment of lifesaving interventions, particularly the integration of malaria prevention and case management with COVID-19 responses. While the pandemic also enabled active online engagements, health care providers with limited access to the Internet faced challenges.
- Collaboration and flexibility in adapting to the project's activities have contributed to project results. The NMCP has taken ownership of activities, and PMM facilitated the NMCP to implement its SME activities.
- Digital technology for malaria data collection, reporting, and analysis can be considered more. It entails expanding information technologies such as electronic registers to improve the timeliness of data reporting.
- The project's legacy in SME needs continuous support from newly funded projects to move forward. The NMCP should also consider extending the PMM technical assistance approach to non-PMI districts and leveraging the achievements.
- Technical support at the provincial level enabled the NMCP to carry out the activities in the operational action plan and national strategic plan. Capacity building at the subnational level was critical since data quality can improve if data producers understand its importance.

Mali

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Mali's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in April 2020, and held a country closeout meeting on June 27, 2023.[13] The PMM Mali team is particularly indebted to the National Malaria Control Programme (NMCP), and to the collaborators in six selected PMM health regions (Bamako, Kayes, Koulikoro, Mopti, Segou, and Sikasso) for their outstanding collaboration and contribution to the successful implementation of the project.

PMI-supported regions

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Streamlining data quality: After conducting training in using the malaria-specific data quality assessment (MRDQA) tool (134 trainees), PMM supported implementation of MRDQA in 44 health districts in five selected health regions for two or three rounds throughout the project time. The project also promoted the use of built-in DHIS2 tools by supporting 52 districts to perform monthly analyses of routine malaria data quality. As a result, data accuracy measured by consistency of reported data between registers and monthly reports was improved, and three regions achieved the target accuracy.

Institutionalizing culture for data analysis and dissemination: At the national level, PMM supported the NMCP in analyzing routine data, writing, and disseminating 37 monthly malaria bulletins. Findings from the bulletins triggered discussions to improve distribution of malaria commodities to reduce stockouts of antimalarials. Moving forward, PMM is working with the civics network to explore options to produce automated malaria bulletins.

Additionally, at the international level, PMM supported preparing poster presentations at the American Society of Tropical Medicine and Hygiene annual meetings.[14]

At the subnational level, PMM pioneered the development of regional-level quarterly bulletins to raise interest in malaria control performance. The six health regions produced and disseminated 42 bulletins between Years 2 and 4. By utilizing those products, the project organized an annual workshop to review performance in each region. The performance of key indicators was assessed against national targets, and action plans were formulated.

Advanced analysis on severe cases: In response to the rising number of severe malaria cases reported through the routine data, PMM convened advanced analysis. Analysis using data from DHIS2 and outpatient health registers, revealed overdiagnosis of severe malaria. The results showed that 75% of patients classified as severe malaria did not have symptoms that characterize severe malaria documented in the registers. Those findings were used to guide the development of the 2023–2027 malaria strategic plan, including capacity-strengthening interventions at health facilities.

[13] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.
[14] "Utility of reporting presumed malaria cases in the context of health system strengthening in Mali (2020)," "Analyzing the distribution and reporting of severe malaria diagnosis in Mali (2022)," and "Misclassification of severe malaria at community health centers and first-level referral health facilities in Mali (2022)."

Result 2: Improved country-level capacities to manage the health information systems

Improved coordination: PMM supported the HIS department in conducting two annual workshops to review health data elements and indicators in DHIS2, customize new data elements and indicators, and clean up the database. Additionally, the NMCP M&E Division has experienced challenges in holding quarterly malaria SME technical working groups. With PMM's technical and logistical support, the NMCP successfully organized 11 quarterly technical working groups and 11 meetings of malaria SME and HIS implementing partners between Years 2 and 4 to strengthen SME governance.

Developed key materials: PMM supported the NMCP in developing key technical documents; the project supported revision of the malaria surveillance guide aligned with the 2016–2030 Global Technical Strategy recommendations. Following the need identified in MRDQA, PMM also developed standard operating procedures and a reference document for malaria data elements and indicators. Finally, in collaboration with malaria stakeholders, PMM made significant contributions to the revision of 2018–2022 strategic plan and the development of 2023–2027 malaria strategic plan and associated M&E plans.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Remote technical assistance: Due to human resources constraints and travel-related challenges, PMM equipped the NMCP and two regions (Kayes and Sikasso) with videoconferencing equipment to test the potential for malaria SME capacity strengthening using remote technical assistance. PMM developed a coaching guide for remote technical support and conducted five virtual training/coaching sessions. The pilot received positive feedback from participants.

Excel-based monitoring tool: Monitoring the progress in action plans formulated by various malaria control programs was a challenge to the NMCP. PMM supported the NMCP to develop a monitoring guide and an Excel-based tool to ensure effective tracking of key recommendations.

Challenges and Lessons Learned

- Annual reviews of malaria performance indicators generated enthusiasm among subnational health teams in understanding how the program was performing in their region/district. It illustrated how the monitoring mechanism built active engagements and facilitated mobilization of financial and technical resources for the project's success. Future SME capacity-strengthening efforts can build on this enthusiasm.
- The NMCP surveillance and operation research division and the planning and monitoring and evaluation division continued to operate as independent entities, leading to coordination problems. The lack of an overall planning system that integrates all malaria control activities prevented timely implementation of activities. PMM engaged the NMCP's new management to discuss the importance of revising NMCP's organizational structure and developing planning tools for better coordination, synergy, and rational use of malaria surveillance resources.
- Establishing a data analysis working group at the NMCP did not meet expectations for timely development of malaria bulletins. The lack of human resources in data analysis within the NMCP was hampering efforts to institutionalize systematic data use for decision-making. PMM advised the NMCP to identify and incentivize at least one staff member who will fully dedicate their time to routine data analysis.
- Introduction of remote malaria SME technical assistance using digital technology had unexpected positive effects in facilitating implementation of other health program activities in the remote regions. However, an adaptation period would be required to effectively operationalize the remote approach.

Republic of the Niger

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Niger's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in April 2020, and held a country closeout meeting on March 6, 2023.[15] Partnering with Ministry of Health's Directorate of Statistics, the National Malaria Control Program (NMCP), and Regional Directorates of the Ministry of Health focus regions, the project worked closely with a malaria SME advisor in Niamey and regional SME officers. The activities covered the central level and two regions (Dosso and Tahoua).

PMI-supported regions

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Malaria SME trainings and tool supply: PMM supported reviewing and implementing the NMCP capacity strengthening plan. The project developed training guidelines and conducted malaria SME training for central and regional NMCP staff to provide them with SME tools, techniques, and other resources needed for planning, monitoring, and assessing achievements of malaria control interventions (25 trainees). Following the identified needs, the project supported an internet system upgrade in the NMCP offices and installed laptops and solar panels in 33 health facilities to enable SME activities.

Improved data quality assurance: PMM adopted the guidelines for malaria data quality assessments (MRDQAs) to the country context and convened MRDQAs and data analysis meetings with trained NMCP personnel. It revealed some service disruptions, such as stockouts of data collection tools and inconsistencies between electronic tools in the DHIS2 platform and paper-based tools (e.g., registers and monthly summary forms). The project then conducted a data quality audit through field visits in 28 health facilities in the two PMI focus regions to help improve data quality. As a result, enhanced data quality was observed regarding timeliness, consistency, and completeness. The reporting timeliness was improved from 33.3% in 2020 to 50.3% in 2022. NMCP trained staff advocated for the scale up of MRDQAs to expand data quality assurances.

Improved data use: PMM supported the NMCP in the monthly analysis of routine malaria data in the DHIS2 database and drafting of malaria bulletins. Consistent documentation contributed to strengthening and validating the 2020 NMCP Niger Annual Report.

Result 2: Improved country-level capacities to manage the health information systems

Coordination for effective strategic planning: PMM collaborated with the Direction de la Statistique and other implementing partners to support monitoring and evaluation (M&E) technical working group meetings to discuss in-country malaria SME. The discussions led to critical feedback on the strategic planning and contributed to the next National Strategic Plan (2022–2026).

Supported activities and survey: PMM supported the seasonal malaria chemoprevention campaigns by participating in joint supervision visits, supporting data collection and analysis, and summarizing lessons for future campaigns. The project also provided technical support for the design and implementation of the 2021 Malaria Indicator Survey in Niger as well as the review and validation of the survey report.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

To increase malaria SME resilience, PMM provided technical assistance to design and implement a pilot project of digital collection of seasonal malaria chemoprevention data using smartphones in six health districts. The NMCP plans to scale this intervention to 20 health districts in the coming years.

[15] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

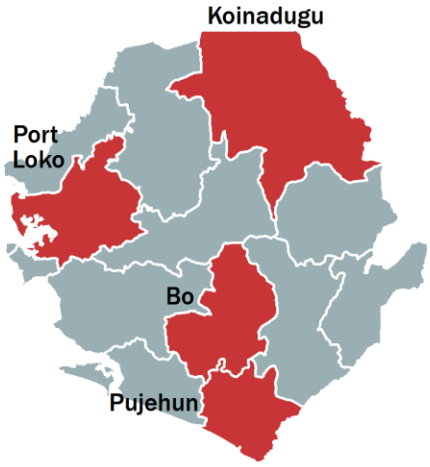
Challenges and Lessons Learned

- The revision and printing of data collection tools (registers and forms) and their incorporation into DHIS2 were delayed by two years. The instability and unavailability of the DHIS2 negatively impacted data analysis for the production and dissemination of malaria bulletins. As a result, PMM could not conduct the training of central/regional-level staff on the use of DHIS2 for data analysis and the DHIS2 data quality review module.
- Insufficient engagement by the NMCP, combined with COVID-19-related restrictions, prevented timely implementation of the project activities. Many SME activities, including technical working groups and data review meetings, required an intensive time commitment by NMCP staff to prepare and follow up effectively. However, securing that commitment was challenging and resulted in limited field visits and data review opportunities. Organizing regular meetings to share interests, review progress, and discuss challenges with the NMCP is critical to enable country-level success.
- Providing technical support through embedded staff can be challenging because the counterpart may become used to the technical advisor and less receptive to advice.
- The physical presence of dedicated project staff in the focus regions improved the quality of implementation and performance of the project in the field.

Sierra Leone

Introduction

The U.S. President's Malaria Initiative (PMI) Measure Malaria (PMM) project started to support Sierra Leone's efforts in strengthening the health information systems (HIS) and malaria surveillance, monitoring, and evaluation (SME) in April 2020, and held a country closeout meeting on May 30, 2023.[16] PMM supported the National Malaria Control Program (NMCP) and the Directorate of Policy, Planning and Information (DPPI) at the national level and provided specific SME interventions at the district level. During three project years, PMM facilitated activities at eight out of 16 districts, starting with three districts (Koinadugu, Bo, and Port-Loko) in Year 2, and expanding to three additional districts (Pujehun, Western Area Rural, and Western Area Urban) in Year 3, and further two additional districts (Falaba and Kailahun) in Year 4.



PMI-supported districts

Key Achievements

Result 1: Strengthened capacities to collect, analyze, and use routine health data

Improved data quality assurance practices: PMM supported the NMCP to develop and implement data quality improvement plans at the health facility, district, and national levels. The project conducted three rounds of malaria routine data quality assessments (MRDQA) in eight districts and visited 160 health facilities. After each MRDQA, the project convened data review meetings, which promoted peer-to-peer learning on data quality improvement. PMM also conducted DHIS2 data verification and cleaning exercises for all 16 districts. The national malaria data verification team was organized, and a monthly verification process was established. In Year 4, success was confirmed through improved completeness (98%) and timeliness (95%) of data for the whole country.

Developed malaria transmission risk profiles: Since Year 1, PMM developed the Malaria Transmission Risk Profiles by chiefdom levels every year. The results revealed significant variation in malaria burdens within districts and identified the need for tailoring strategies at chiefdom levels. The profiles enabled NMCP to conduct risk stratification analysis and an effective targeting approach with high-burden areas.

Improved data use: With PMM support, the NMCP presented time trends of key malaria indicators during annual data review meetings to enable evidence-based planning. The monitored indicators included malaria morbidity, mortality, incidence, and commodity consumption. Those enhanced analysis practices also contributed to the country's effective response to COVID-19 pandemic through timely case monitoring and data-driven approaches. For example, PMM monitored adherence to COVID-19 prevention measures implemented during NMCP's long-lasting insecticidal nets mass campaign and found better adherence among the distribution teams than the beneficiaries and applied the finding to program implementations.

Improved dissemination of data: Multiple key dissemination materials were developed, including country malaria fact sheets for World Malaria Day in Year 3 and 4, malaria surveillance bulletins, and three poster presentations at the American Society of Tropical Medicine and Hygiene annual meetings.[17]

[16] Year 1: from April 2020 to June 2020, Year 2: from July 2020 to June 2021, Year 3: from July 2021 to June 2022, and Year 4: from July 2022 to May 2023.

[17] "Assessing COVID-19 Infection Prevention and Control Measures Implemented during a Mass ITN Campaign in Sierra Leone (2020)," "Defining Malaria "Transmission Risk Profiles at the Subnational Level in Sierra Leone Using Health Facility Data (2022)," and "Initial Assessment of the Quality of Malaria Routine Data in Selected Health Facilities in Sierra Leone 2021 (2022)."

Result 2: Improved country-level capacities to manage the health information systems

Developed strategic documents: PMM contributed to developing strategic documents to guide malaria activities in

Sierra Leone. Key materials included the National Malaria Strategic Plan (2021–2025) and the National Malaria SME Plan (2021–2025).

Knowledge capacity building: The project's capacity building training covered a broad range of key stakeholders. 16 district M&E officers and 16 district malaria focal persons completed intensive three-day training, which included an opportunity to summarize and present key malaria indicators to attending district leaderships. The data review meetings at facility levels also worked as a knowledge-sharing space, where PMM engaged with 560 healthcare workers.

Improved stakeholder coordination: Implementation of quarterly malaria SME technical working group meetings and active engagement with larger Health Management Information System and M&E stakeholders facilitated improved coordination of malaria activities.

Result 3: Enhanced tools, methods, and approaches to address health information challenges

Supervision checklist for monitoring program implementation: In Year 3, PMM organized a two-day workshop to revise the Supervision Checklist. The format was updated and validated for the first time in 15 years, and the project digitized the checklist to enable easy tracking.

Innovative tool for measuring data quality: After successfully implementing the MRDQAs, PMM piloted a mobile application version of the MRDQA tool in five selected health facilities. While the pilot revealed challenges in the inconsistency of DHIS2 versions between MRDQA apps and facilities operating DHIS2 systems, it also identified the need for cost-effective digital solutions in data reporting and assessment.

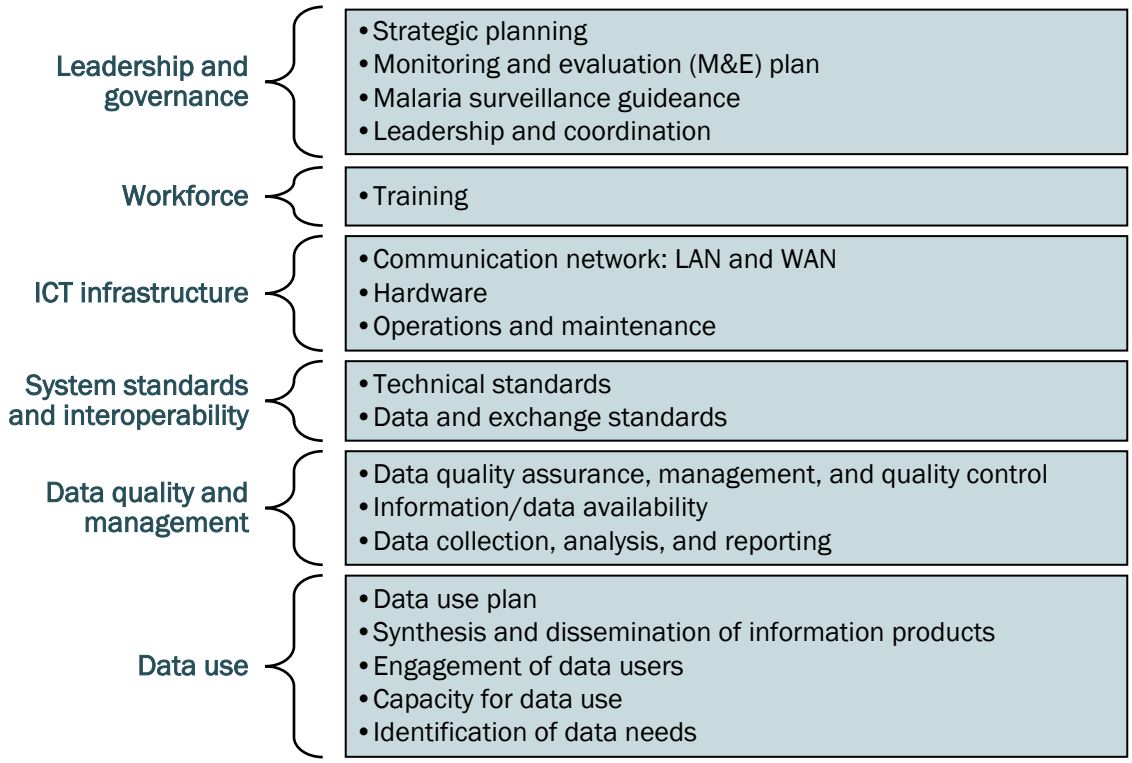
Challenges and Lessons Learned

- Strong relationships with NMCP and Ministry of Health and Sanitation's leadership and stakeholder meetings facilitated good coordination in PMM. More collaborations beyond the NMCP, including with in-country academic institutions, are needed to further promote the uptake of malaria SME interventions and continuous capacity building.
- Digital technology, including electronic registers and machine learning, can be leveraged more to support real-time data collection, reporting, and analysis. A significant reporting burden by paper-based tools at the health facility level was reported. While COVID-19 has opened more online opportunities, limited inclusiveness for healthcare workers without the internet should be addressed.
- To achieve seamless coordination from subnational to national levels, PMM identified the need for revised manuals and standard operating procedures with clear responsibilities for chiefdom data entry officers and district M&E data officers. DPPI is planning to revise the Health Management Information System data reporting tools in late 2023. This process would also be an opportunity to address the severe cases and inpatient data gaps.
- Incessant stockouts of blank data entry forms were reported as a critical obstacle for effective reporting. DPPI and relevant partners could improve their printing and distribution of data management tools to prevent such stockouts.
- As data quality can only improve if data producers understand its importance, capacity building at subnational levels was critical. In PMM, technical support at the district level played a key role and led to the inclusion of malaria activities into district operational plans. At community levels, active engagements with Community Health Workers can be considered more to support an effective surveillance system. This experience should be leveraged in the remaining eight non-PMI districts.

Appendix 3. Malaria Information Index Findings

The Malaria Information Index (MII) was created by PMI Measure Malaria (PMM) as a framework and tool for measuring the status of components of malaria surveillance, monitoring, and evaluation (SME). The MII is structured along a continuum and applies a five-point scale to 18 components organized into six domains (shown in Figure A1) and four system-level outcomes of data quality and use. Complimentary data elements are collected for select domains to provide additional context on the health information systems (HIS) and malaria SME capacities. The MII has provided an annual snapshot of the status of these components in PMM-supported countries (or PMM-supported country regions) to help guide the project's collaborating, learning, and adapting (CLA) approach. PMM worked with SME advisors to collect three rounds of MII data: Round 1 in June 2020, Round 2 in November 2021, and Round 3 in November 2022. This brief shares average scores and lessons learned from the MII data collected from across eight PMM-supported countries.

Figure A1. MII domains and components



MII Average Scoring Across PMM-Supported Countries

MII data from Rounds 1–3 were collected using an Excel workbook to measure HIS and SME system capabilities in PMM-supported regions. For each of the 18 components (see Figure A1), SME advisors reviewed the scale level descriptions and selected the level that best fit the country context. Alongside the quantitative scores, SME advisors also provided a brief justification citing evidence to support the scale-level selection, including improvements in specific components over time.

Scores from each of the eight PMM-supported countries were combined to show average scoring for Rounds 1, 2, and 3. The average scores for the components of HIS management (for the domains of: leadership and governance, workforce, information and communications technology [ICT] infrastructure, and system standards and interoperability) are shown in Figure A2.

His Management

Figure A2. Average scores in HIS management by component

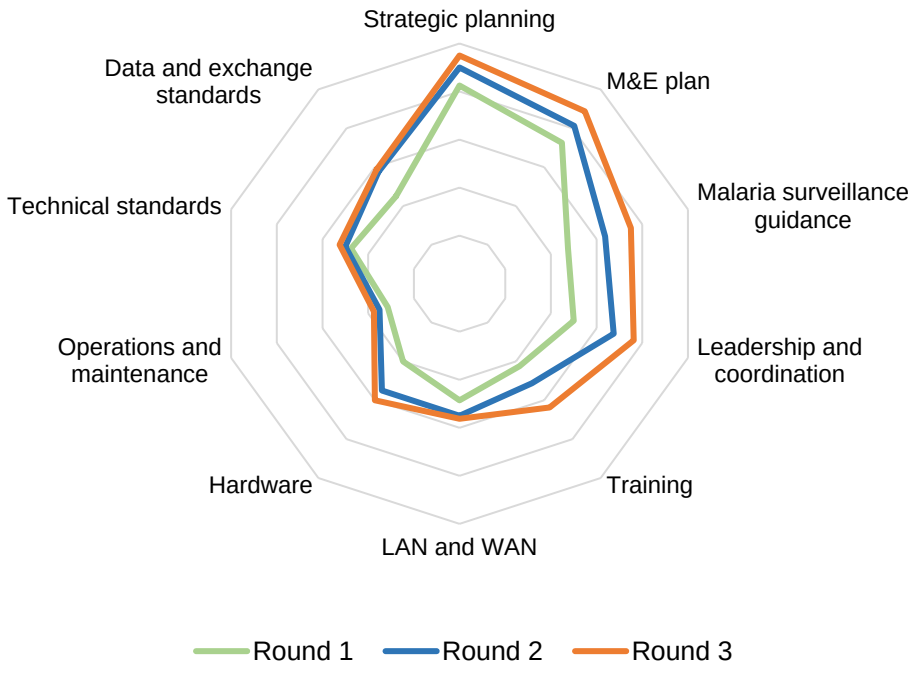


Table A3.1 shows the net change in average score from Round 1 to Round 3 **specifically for PMM-supported components.** PMM support led to gains in the PMM-supported components of **strategic planning, M&E plan, malaria surveillance guidance, and leadership and coordination**. Qualitative responses provided alongside the scores were also reviewed and analyzed for themes from across the eight PMM-supported countries.

Table A3.1. Overall change in average scoring for PMM-supported components

	Strategic planning	M&E plan	Malaria surveillance guidance	Leadership and coordination	Training
Round 1 average score	4.1	3.6	2.4	2.5	2.1
Round 3 average score	4.8	4.4	3.8	3.8	3.2
Change from Round 1 to 3	0.6	0.8	1.4	1.3	1.1

The average scores for Rounds 1 and 3 are presented in Table A3.1 along with the overall net change in scores from Rounds 1 to 3. Table cells with darker green shading highlight components with a net increase greater than 1 (based on the index scoring scale of 1–5). Improvements in HIS management scoring can be seen in all PMM-supported components, especially in the components of malaria surveillance guidance and leadership and governance with net improvements in average scoring of 1.4 and 1.3, respectively. Under the domain of workforce, the component of training was also strengthened significantly with a 1.1-point net increase in scoring across countries.

Table A3.2 describes facilitators of improvements for each of the components, as well as remaining barriers. The themes noted in this table related to HIS and SME strengthening efforts were observed by looking across the qualitative justifications from all eight countries for each component. Themes noted here describe facilitators to HIS/SME strengthening seen in two or more country settings (usually three or more), as well as common barriers that were described by SME advisors. Not all components measured by the MII were directly supported through PMM's scope of work. PMM collected data for each MII component to capture a holistic view of the systems and processes that support the collection and use of high-quality malaria information.

Table A3.2. Themes observed for components of HIS management

Domain	Component	Facilitators and barriers of HIS/SME strengthening
Domain 1: **Leadership and governance**	1a: Strategic planning	• Midterm reviews of the national malaria strategic plan resulted in updates and adaptive management in planning documents • Many countries still fell short of adaptive management beyond midterm or annual reviews (e.g., responsiveness to outbreaks or disruptions such as COVID-19)
	1b: M&E plan	• M&E plans were strengthened by aligning them with the strategic plan and defining clear indicators, measurement approaches and data sources, and support to the national malaria control program (NMCP) to operationalize them
	1c: Malaria surveillance guidance	• The response to the COVID-19 pandemic contributed to strengthened surveillance practices by way of additional resources invested in surveillance activities in select countries • The World Health Organization (WHO) guidelines for malaria surveillance M&E have guided countries to develop and improve their national malaria surveillance guidance
	1d: Leadership and coordination	• Planning for regular convening of technical working group meeting and other leadership fora when needed supports opportunities for coordination and oversight • Limited national ownership and dedicated funding for coordination and technical working groups leads to potential challenges in sustainability and coordination
Domain 2: **Workforce**	2a: Training	• Lack of dedicated funding and integration into national strategic plans are barriers to regular and consistent training. Training is often funded by implementing partners and not always budgeted for in country planning • Challenges in distance/remote learning options reduce the potential coverage of training benefitting health providers
Domain 3: **ICT Infrastructure**	General: ICT infrastructure	• ICT is often not integrated or budgeted for in strategic planning; support often comes from project partners without long term plans to sustain improvements
	3a: Communication network: LAN and WAN	• Network connectivity is often a challenge for at least some regions in each country and consistent connections remain an issue in many settings
	3b: Hardware	• Improvements in scoring in hardware are often due to partner support in procuring equipment
	3c: Operations and maintenance	• Lack of dedicated support teams and funding limit opportunities for regular maintenance and sustainability
Domain 4: **System standards and interoperability**	4a: Technical standards	• A procedures manual or other documentation support standardization and increased use of technical standards
	4b: Data and exchange standards	• ICT assessments have helped to identify needs that inform prioritization or action planning • Countries recognize the need and in some cases develop national HIS data management policy and guidelines but often these have not yet been fully implemented or disseminated • Integration of standard operating procedures (SOPs) related to data exchange into national strategy supports implementation

Data Quality And Management

Figure A3 shows the average scoring from Rounds 1 to 3 for the components of data quality and management. Table A3.3 shows the net change in average scoring from Round 1 to Round 3 for each component.

Figure A3. Average scores in data quality and management by component

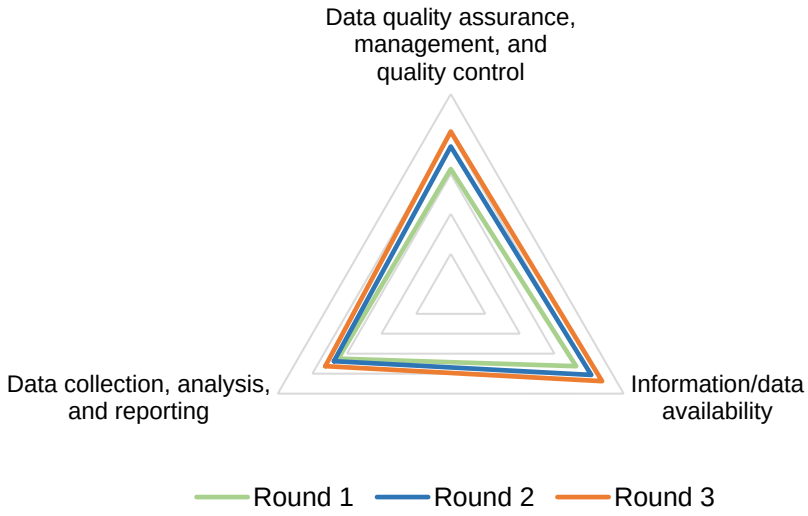


Table A3.3. Overall change in average scoring for data quality and management components

	Data quality assurance, management, and quality control	Information/data availability	Data collection, analysis, and reporting
Round 1 average	3.1	3.6	3.3
Round 3 average	4.1	4.4	3.6
Change from Round 1 to 3	0.9	0.8	0.4

Improvements in scoring can be seen in the components of data quality and management, especially in data quality assurance, management, and quality control with a net improvement of 0.9 in score. PMM supported the three components of data quality and management in all countries, and we can see improvement in all three, although the net increase in scoring was lower in data collection, analysis, and reporting. This may be related to the often inconsistent availability of reporting tools or challenges with the DHIS2 platform in which PMM was not directly involved. Table A3.4 describes common themes observed from the data quality and management components as facilitators or barriers to progress in each component.

Table A3.4. Themes observed for components of data quality and management

Domain	Component	Themes/notes/observations
***Domain 5:* Data Quality and Management**	5a: Data quality assurance, management, and quality control	• Regular data quality review and training of health providers in data management practices and processes • The DQA modules in DHIS2 facilitates the assessment of reporting completeness, data elements completeness, and accuracy • Malaria Routine Data Quality Assessment (MRDQA) site visits facilitate data quality assurance action planning
	5a: Data quality	• The MRDQA has contributed to improvements in data quality • Regular data quality reviews support improved data quality • Introduction of new processes/systems for data capture and/or reporting may lead to an initial decrease in timeliness
	5b: Information/ data availability	• Increases in available quality and timely data facilitate increased user demands for data, including secondary data • Systems in place and regular meetings with standing agenda items support availability of data
	5c: Data collection, analysis, and reporting	• Shortages in creation and distribution of data collection and reporting tools may affect data reporting • Occasional interruption of DHIS2 may affect timely data reporting • Increased understanding and access to DHIS2 by providers increases data reporting timeliness and completeness • Introduction of new processes/systems for data capture and/or reporting may lead to an initial decrease in timeliness • Automation supports basic analysis and report generation

Data Use

Figure A4 shows the overall average scores for Rounds 1–3**.** Table A3.5 shows the net change in average scoring from Round 1 to Round 3 for each component.

Figure A4. Average scores in data use by component

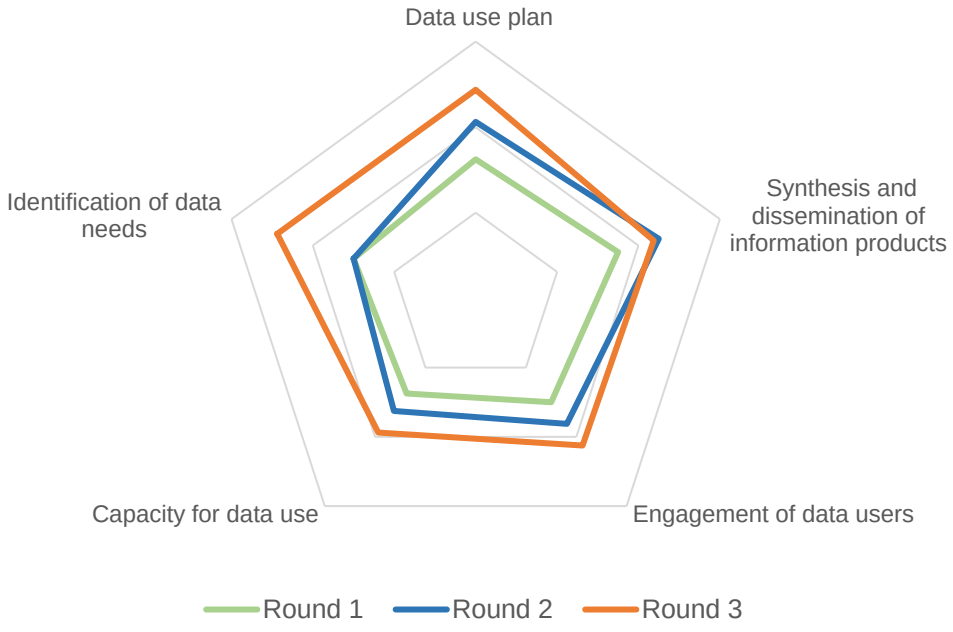


Table A3.5. Overall change in average scoring for data use components

	Data use plan	Synthesis and dissemination of information products	Engagement of data users	Capacity for data use	Identification of data needs
Round 1 average	1.6	1.8	1.5	1.4	1.5
Round 3 average	2.4	2.2	2.1	1.9	2.4
Change from R1 to R3	0.8	0.4	0.6	0.6	0.9

PMM support led to gains in all areas of data use, especially for the components of the data use plan and identification of data needs. Facilitators and barriers related to each of these components can be found in Table A3.6.

Table A3.6. Themes observed for components of data use

Domain	Component	Themes/notes/observations
Domain 6: **Data use plan**	6a: Data use plan	• Existence of a data use plan supports improved data use culture • Data use plans are developed but dissemination is often limited and plans often lack accompanying data use curricula
	6b: Synthesis and dissemination of information products	• Information products such as quarterly bulletins are frequently produced with technical and financial support through PMI implementing partners • Information products are frequently planned for and developed but challenges remain in disseminating products widely
	6c: Engagement of data users	• Midterm reviews helped with the engagement of data users • Data review meeting guidance leads to improvements in engagement of data users • Regular coordination of data validation meetings leads to improved data use
	6d: Capacity for data use	• Ongoing opportunities for additional staff training to support effective data use
	6e: Identification of data needs	• Data requests often happen in preparation for review and planning meetings (often as verbal requests); and there are often not systems/standardization for how this occurs other than being linked to meeting planning

Country Scores

Table A3.7 shows the malaria information index score range by country at baseline and at year 3. The countries are ordered from lowest malaria burden (Kenya) to highest malaria burden (Sierra Leone). The table is color-coded. White cells represent an MII score of 1 and darker colors represent higher scores, with the darkest green being a score of 5.

Table A3.7. MII score heatmap

		Kenya		Madagascar		Mali		Cameroon		Côte d'Ivoire		DRC		Niger		Sierra Leone	
Domains of HIS Management		R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3
Leadership and Governance	1a: Strategic planning																
	1b: M&E plan																
	1c: Malaria surveillance guidance																
	1d: Leadership and coordination																
Workforce	2a: Training																
Domains of Data Quality and Use		R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3
Data Quality and Management	5a:Data quality assurance, management, and quality control																
	5b: Information/ data availability																
	5c: Data collection, analysis, and reporting																
Data Quality and Use		R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3	R1	R3
Data use (SCALE OF 1-3)	6a: Data use plan																
	6b: Synthesis and dissemination of information products																
	6c: Engagement of data users																
	6d: Capacity for data use																
	6e: Identification of data needs																

Summary

Results from the MII data collection provide a snapshot of the status and strengthening of HIS and malaria SME systems over the three years of the project. The scores from Rounds 1 through 3 show where strengthening has been achieved and also show where challenges remain. The components directly supported by PMM showed noteworthy gains in scoring over the three years of project support, as compared to the components that were not directly supported. Improvements in average scoring can be observed in all components measured by the MII, in part due to support from other partners working in each region and also likely because any one component is not isolated from the strengthening effects of related components.

Future efforts to support malaria HIS and SME should build on the progress and lessons learned from the components that were strengthened and should also consider where additional strengthening may be needed to sustain gains, especially in ICT infrastructure and data standards and interoperability.

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