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# Cambodia Malaria Elimination Project

## FINAL REPORT

Contract Number: AID-442-C-17-00001

Period of Performance: October 26, 2016, to October 25, 2021

Submitted: January 21, 2022

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*Cover Photo: A VMW conducts malaria testing for a migrant worker during a health education campaign organized by CMEP sub-grantee, AHEAD, in Battambang OD, Battambang Province, July 2021. (Credit: Saban Samloth, CMEP)*

### Disclaimer

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# ACRONYMS / ABBREVIATIONS

ACT	Artemisinin-Based Combination Therapies
AHEAD	Action for Health Development (CSO in Cambodia)
AOP	Annual Operational Plan
API	Annual Parasite Incidence
ASMQ	Artesunate-Mefloquine
BCC	Behavior Change Communication
BKN	Bakan
BTB	Battambang (OD)
CHAI	Clinton Health Access Initiative
CBO	Community-Based Organization
CDC	U.S. Centers for Disease Control and Prevention
CMEP	Cambodia Malaria Elimination Project
CNM	Cambodian National Center for Parasitology, Entomology and Malaria Control
cRDT	Conventional Rapid Diagnostic Test
CSO	Civil Society Organization
DOT	Directly Observed Therapy
EDAT	Early Diagnosis and Treatment
EMMP	Environmental Mitigation and Monitoring Plan
FY	Fiscal Year
G6PD	Glucose-6-Phosphate Dehydrogenase
GHSC-PSM	Global Health Supply Chain Program – Procurement and Supply Management
HC	Health Center
HF	Health Facility
HMIS	Health Management Information System
HSD	Health and Social Development
hsRDT	Highly Sensitive Rapid Diagnostic Test
IP-1	CNM Intensification Plan 1, 2018
IP-2	CNM Intensification Plan 2, 2019
IPC	Interpersonal Communication
ITN	Insecticide-Treated Net
KRK	Krakor
LLIN / LLIHN	Long-Lasting Insecticide-Treated Net / Hammock Net
LOE	Level of Effort
M&E	Monitoring and Evaluation
MEAF 2	Malaria Elimination Action Framework 2021-2025
MIS	Malaria Information System
MMP	Mobile and Migrant Populations
MMW	Mobile Malaria Worker
MOH	Ministry of Health
MORU	Mahidol Oxford Tropical Medicine Research Unit
MRS	Maung Russey
NECHR	National Ethics Committee Health Research
NTG	National Treatment Guideline
OD	Operational District
ODMS	Operational District Malaria Supervisor
OEC	Operation Enfant Cambodge (CSO in Cambodia)
PCR	Polymerase Chain Reaction
<i>Pf</i>	<i>Plasmodium falciparum</i>
PFDA	Partner for Development in Action (CSO in Cambodia)
PHB	Promoting Health Behaviors
PHD	Provincial Health Department
PITT	Performance Indicator Tracking Table

PKV	Phnom Kravanh
PLN	Pailin
PMI	U.S. President's Malaria Initiative
PP	Private Provider
PPM	Private-Public Mix
PQ	Primaquine
Pro-TWGH	Provincial Technical Working Group for Health
PSA	Public Service Announcement
PSI	Population Services International
<i>Pv</i>	<i>Plasmodium vivax</i>
PY	Project Year
RDT	Rapid Diagnostic Test
SBCC	Social and Behavior Change Communication
SLDPQ	Single Low-Dose Primaquine
SOP	Standard Operating Procedure
SPL	Sampov Loun
SPM	Sampov Meas
SWGME	Special Working Group for Malaria Elimination
TMK	Thmar Kaul
UNOPS	United Nations Office for Project Services
URC	University Research Co., LLC
USAID	United States Agency for International Development
U.S.	United States
VMW	Village Malaria Worker
WHO	World Health Organization
WMD	World Malaria Day

# EXECUTIVE SUMMARY

The Cambodia Malaria Elimination Project (CMEP) of the U.S. President’s Malaria Initiative, a program co-led by the U.S. Agency for International Development, launched in October 2016. CMEP supports the Cambodian National Center for Malaria Control, Parasitology and Entomology (CNM) to reduce malaria morbidity and mortality and reach their goal of malaria elimination nationwide by 2025.

The Project achieved this goal through four strategic objectives:

1. Develop a scalable, evidence-based elimination model in Sampov Loun (SPL) Operational District (OD) and support its dissemination and replication for malaria elimination in Cambodia.
2. Support the scale-up of high-quality malaria control and prevention interventions in five to eight ODs, where gaps in coverage or quality exist.
3. Strengthen national malaria surveillance systems as well as monitoring and evaluation appropriate for malaria elimination and control activities.
4. Build the capacity of the malaria program to manage, intensify, and sustain malaria control and elimination efforts, particularly at the OD level.

CMEP developed and piloted the evidence-based 1-3-7 elimination model in SPL OD as a demonstration of a responsive, data-driven malaria elimination model. This model was further scaled to all CMEP elimination ODs and beyond. In elimination ODs outside of the CMEP catchment area, the Project provided expert technical assistance in implementing the model, responding to data, and working toward national malaria elimination in Cambodia. The model — which seeks to achieve SMS-based case notification within 24 hours (one day), case investigation within three days, and case response within seven days (hence the 1-3-7 name) — improves data availability, strengthens case response, and mitigates community transmission of malaria. By Year 5, CMEP-supported ODs reported 99% of cases within 24 hours, investigated 98% of cases within three days, and responded to 100% of cases within seven days. Ongoing efforts to reduce investigation and response times have been successful: by Year 5, 17% of cases received investigation and response on Day 1, an additional 35% of cases received investigation and response by Day 2, and a further 36% received investigation and response by Day 3. The lessons learned from this model will strengthen ongoing elimination efforts and serve as essential infrastructure for eliminating malaria.

In ODs preparing for elimination interventions, CMEP provided high-quality technical assistance and capacity building at all levels. Partnering with entities of the Royal Government of Cambodia — including CNM, provincial health departments, OD health staff, health center (HC) staff, and village malaria workers — CMEP hosted trainings on data recording and management, case management, interpersonal communication, and operational planning. CMEP distributed over 418,000 long-lasting insecticide-treated nets and provided interpersonal communication to over 618,000 individuals over the life of the Project, illustrating the wide reach of CMEP efforts in finding malaria cases in the community, raising awareness about malaria among at-risk populations, and providing helpful tools for malaria prevention, detection, and treatment.

In addition to these community-based approaches for reducing malaria transmission and setting the stage for malaria elimination in Cambodia, CMEP provided OD-level planning and policy support to institutionalize malaria programming in annual operational plans and ensure adequate resources for high-quality programming. At the national level, CMEP provided expert technical assistance for high-level guidance documents and assisted in the development, dissemination, and implementation of the Malaria Elimination Action Framework 2, 2021-2025.

As Cambodia continues to make progress toward malaria elimination, gains in data quality, operational planning, and case finding must be protected and expanded at all levels. Applying these evidence-based interventions at the village level based on epidemiologic trends, continuing working groups’ progress, and preventing the reintroduction of malaria in areas where malaria has been eliminated will be essential technical priorities to continue encouraging the progress made during CMEP.

# INTRODUCTION

## 1. Background and Context

During the past two decades, Cambodia has moved steadily toward malaria elimination under the leadership of the National Center for Parasitology, Entomology and Malaria Control (CNM), with the last malaria death in Cambodia recorded in 2017. The decline has been particularly due to increased access to insecticide-treated nets (ITNs) as well as diagnosis and treatment through the network of village malaria workers (VMWs) established in 2004. The expansion of the VMW network to high-risk, remote areas has facilitated a community-level response to malaria. The Cambodia Malaria Elimination Project (CMEP) of the U.S. President’s Malaria Initiative (PMI), a program co-led by the U.S. Agency for International Development (USAID), is built on eight years of previous USAID investments in malaria control in Cambodia under the Control and Prevention of Malaria (CAP-Malaria) Project from 2011 to 2016 and the Malaria Control in Cambodia (MCC) Project from 2008 to 2011, both USAID PMI projects implemented by University Research Co., LLC (URC).

## 2. Program Description

CMEP, which launched in October 2016, supported CNM to reduce malaria morbidity and mortality and reach their goal of malaria elimination nationwide by 2025. To reach this goal, the Project achieved strategic objectives: (1) Develop a scalable, evidence-based elimination model in Sampov Loun (SPL) Operational District (OD) and support its dissemination and replication for malaria elimination in Cambodia. (2) Support the scale-up of high-quality malaria control and prevention interventions in five to eight ODs where gaps in coverage or quality exist. (3) Strengthen national malaria surveillance systems and monitoring and evaluation (M&E) appropriate for malaria elimination and control activities. (4) Build the capacity of the malaria program to manage, intensify, and sustain malaria control and elimination efforts, particularly at the OD level. CMEP used an approach centered on health ODs to build capacity for ongoing malaria control, prevention, and elimination. The CMEP team actively supported developing, implementing, and monitoring OD annual operational plans (AOPs) and introducing data visualization to support data use. Joint supervision at all levels strengthened both.

## 3. Implementing Partners

CMEP worked extensively with CNM and other government counterparts at all levels. CMEP also engaged implementing partners, including the Global Health Supply Chain/Procurement and Supply Management Program for buffer commodities; Population Services International (PSI) for social and behavior change communication (SBCC); the Institut Pasteur of Cambodia for glucose-6-phosphate dehydrogenase (G6PD) testing; the Clinton Health Access Initiative (CHAI) for trainings and workshops; the Global Fund to Fight AIDS, Tuberculosis, and Malaria (often referred to simply as the Global Fund) for commodities and coordination meetings; and the World Health Organization (WHO) for strategy and guidance development. CMEP engaged the civil society organizations (CSOs) Action for Health Development (AHEAD) and Partner for Development in Action (PFDA) for improved program coverage and access to hard-to-reach populations in remote/forested areas.

### ***Box 1: Geographic Focus and Beneficiaries***

CMEP worked in 14 ODs covering six provinces — Battambang, Pailin, Pursat, Kep, Kampot, and Koh Kong. Out of the 14 ODs, elimination activities were implemented in seven. In Battambang Province, there were four ODs (SPL, Battambang [BTB], Maung Russey [MRS], Thmar Kaul [TMK]). In Pailin Province, there was one OD abbreviated as PLN. And in Pursat Province, there were two ODs (Sampov Meas [SPM] and Bakan [BKN]).

CMEP worked in two transitional ODs — both in Pursat Province (Phnom Kravanh [PKV] and Krakor [KRK]). In transitional ODs, intensified malaria activities in high-risk villages and forest location were conducted as part of the second intensification plan (IP-2). CMEP also provided technical assistance to five ODs in the provinces of Kep, Kampot, and Koh Kong.

# PROGRAM ACHIEVEMENTS AND INTERVENTIONS

## 1. Goal: Support CNM to reduce malaria morbidity and mortality and reach the goal of malaria elimination nationwide by 2025

CMEP has met or exceeded all targets for impact achievement, including targets for the annual parasite incidence (API), severe malaria cases, and test positivity. The Project has been particularly successful in identifying suspected malaria cases in the community, using rapid diagnostic tests (RDTs) to confirm malaria cases, and starting patients on treatment upon diagnosis. These successes are illustrated through the decreased number of cases, decreasing API in Project-supported areas (Figure 1), and decreasing test positivity over time (Figure 2). There was zero malaria death in Cambodia from 2018 onward.

### Impact Achievement

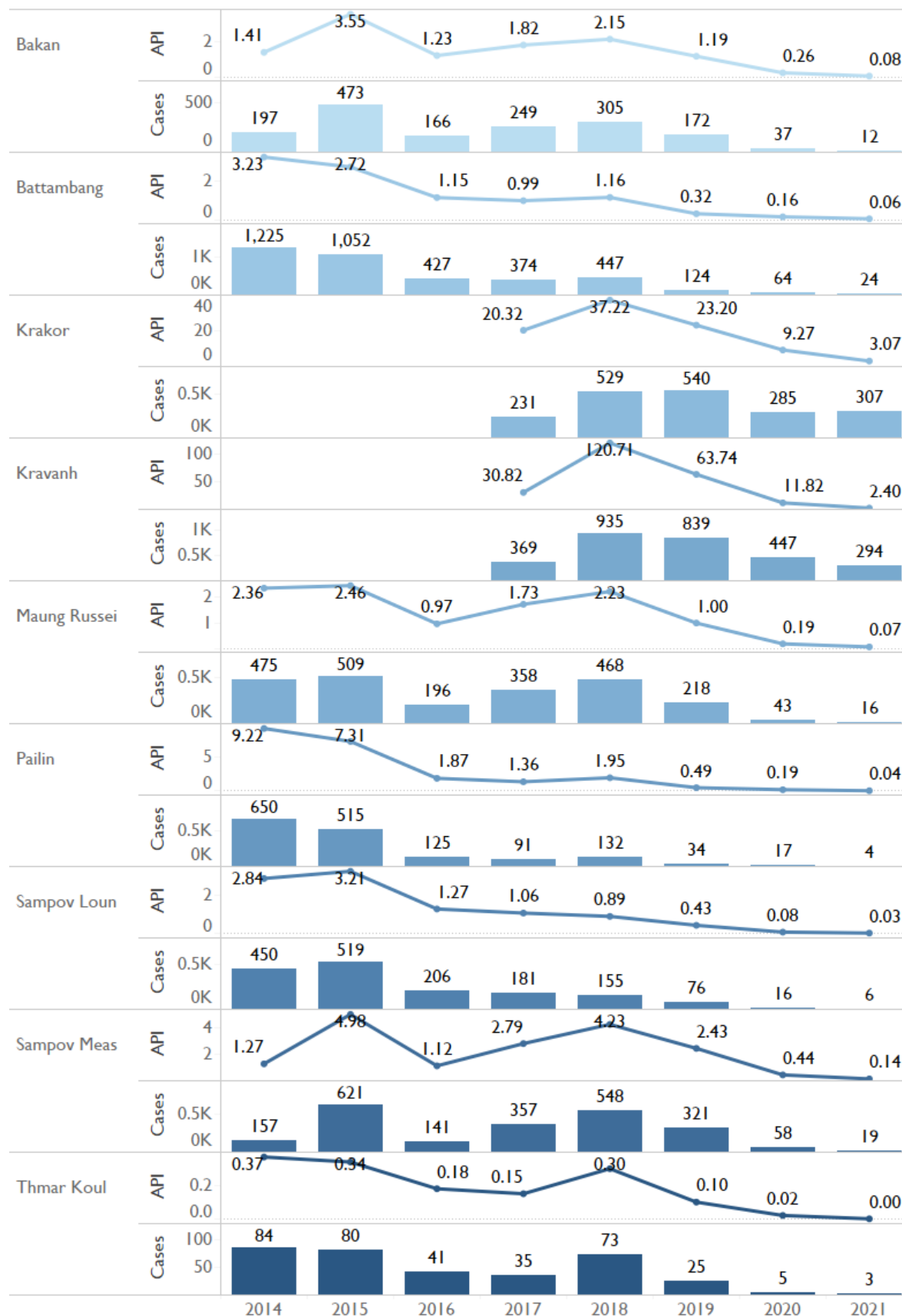
API (per 1,000): 0.44 (Target = 0.60)

Severe cases per 100,000: 0 (Target = 0)

Test positivity rate: 1% (Target = 6%)



**Cases and API (all species) by OD, FY 2014 to FY 2021**



**Figure 1: Cases and API by OD, 2014 to 2021**

### Test Positivity Rate over Time

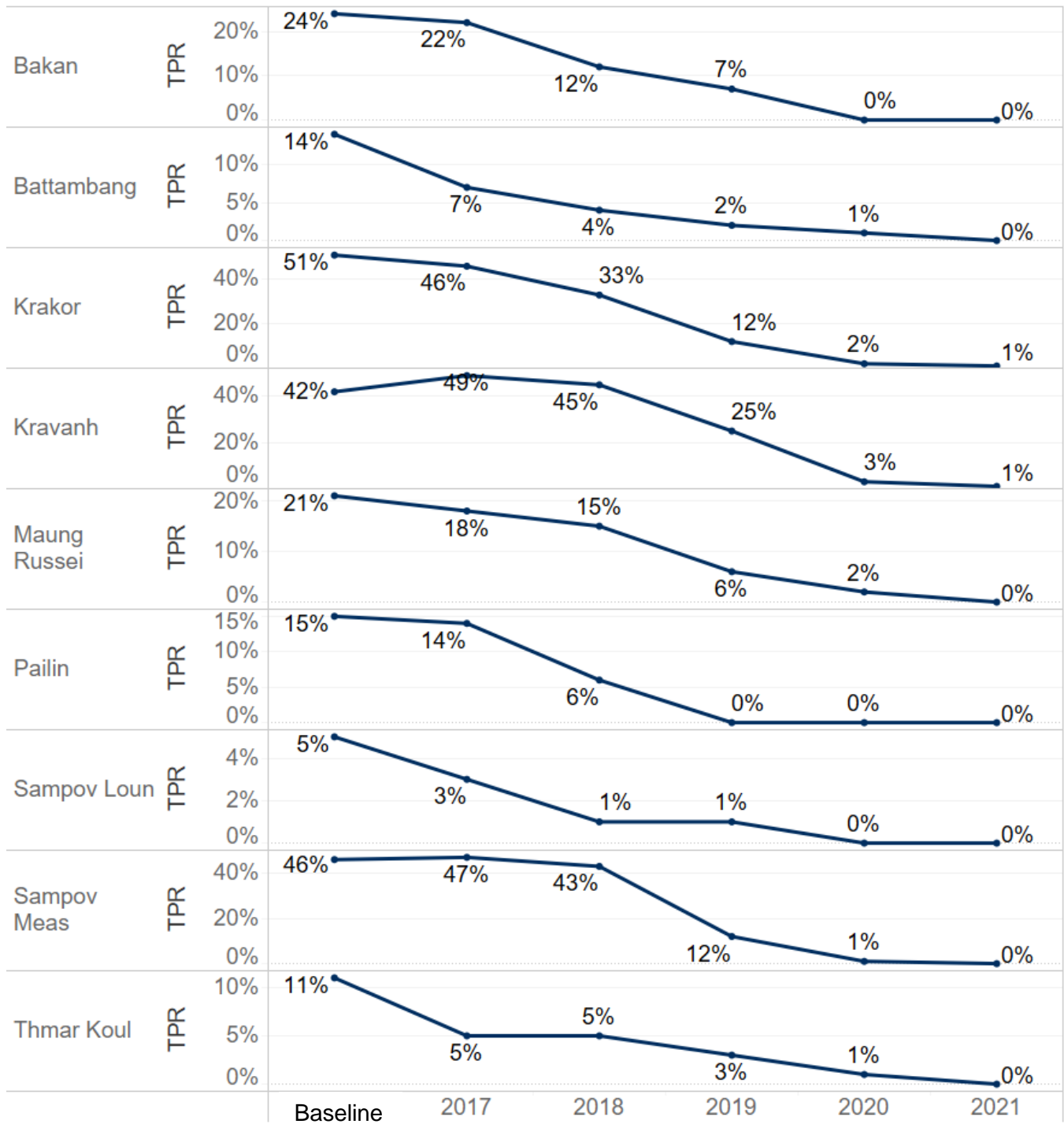


Figure 2: Test Positivity Rate Over Time

## 2. Objective 1: Develop a scalable, evidence-based elimination model in SPL OD and support its dissemination and replication for malaria elimination in Cambodia

In partnership with the CNM, CMEP developed a scalable, evidence-based elimination model at the OD level. The 1-3-7 model seeks to notify malaria cases within one day (24 hours), conduct investigation activities within three days, and conduct response activities within seven days of case detection (hence the 1-3-7 name). The model has been successful in Cambodia, as shown by a decreasing number of cases reported and decreasing API (Figure 1). Throughout the Project, CMEP expanded the reach of the 1-3-7 model, built capacity at the OD and provincial levels for implementation, and disseminated essential technical knowledge for further expansion of this model outside of Project catchment areas.

### Objective 1 Achievements

% suspected malaria cases that received a parasitological test: 100% (Target = 100%)

% of all confirmed cases that received appropriate malaria treatment under directly observed therapy (DOT) according to the National Treatment Guidelines (NTGs): 96% (the fiscal year 2021 [FY2021]; Target = 94%)

% of all diagnosed malaria cases that were reported to the appropriate responding team within one day/24 hours: 99% (FY2021; Target = 100%)

% of all confirmed malaria cases that were investigated, classified (local versus imported), and reported within three days of diagnosis: 98% (FY2021; Target = 100%)

% of confirmed active foci investigated in which an appropriate response

### A. Situation Analysis and Planning

The 1-3-7 model was first introduced in SPL OD in 2015 under the CAP-Malaria Project. Model implementation is based on thorough, context-specific pre-implementation situational assessments for all ODs. CMEP conducted an initial assessment in SPL OD since it was the first OD to implement 1-3-7. This assessment found significant reductions in API and the number of *Plasmodium falciparum* (*Pf*) cases and mixed *P. vivax/P. falciparum* (*Pv/Pf*) cases (often collectively called “*Pf*/mix cases”) attributable to the 1-3-7 model. It also found that the gains achieved through this elimination model should continue to be leveraged by Project activities, including the distribution of long-lasting insecticide-treated nets (LLINs), malaria education, improvements to the VMW network, and quality assurance and quality control through supportive supervision. Furthermore, engagement with relevant stakeholders through the technical working group platform (i.e., provincial and district special working groups for malaria elimination) made the 1-3-7 model successful. Based on these achievements, CMEP expanded the reach of the 1-3-7 model during the Project’s life to five ODs in 2018<sup>1</sup> and to seven ODs in 2019<sup>2</sup>. Additionally, from December 2019, the Project has provided technical assistance to five additional ODs in three provinces outside of the CMEP coverage area to support the model’s wider implementation in Cambodia

<sup>1</sup> Sampov Loun (SPL), Battambang (BTB), Maung Russey (MRS), Thmar Kol (TMK) and Pailin (PLN)

<sup>2</sup> SPL, BTB, MRS, TMK, PLN, Sampov Meas (SPM) and Bakan (BKN)

generally. Those ODs included Kampot (KPT) and Chhouk (CHK) of Kampot province, KEP of Kep province, Smach Meanchey (SMC) and Srae Ambel (SAB) of Koh Kong province.

To achieve this success and to continue progress toward elimination, CMEP worked in close collaboration with CNM to develop and refine tools and documentation for malaria elimination. They include standard operating procedures (SOPs), reporting and recording forms, and job aids for different cadres of health care workers — including those at the health facility (HF) level, VMWs, private providers (PPs), and OD teams. In the Project’s later years, CMEP worked closely with CNM and WHO in developing SOPs, job aids, training manuals, and reporting forms. Such tools were developed for foci investigation, *Pv* radical treatment, and G6PD testing — essential tools for realizing malaria elimination in Cambodia. CMEP also worked with CNM, WHO, and other partners to disseminate these tools to Cambodia’s relevant implementers: provincial health departments (PHDs), ODs, HFs, VMWs, and mobile malaria workers (MMW). These efforts encouraged a shift from qualitative testing (rapid diagnostic tests [RDTs]) for G6PD to quantitative testing (SD Biosensor). These innovations respond to the changing needs in the malaria elimination landscape in Cambodia, especially the need for cutting-edge tools for identifying and treating *Pv* malaria.

## B. Capacity Building

Over the course of the Project, CMEP has sustainably built the capacity of health care workers in Cambodia across the health system, including HF staff, VMWs, and PPs. Based on evidence from an initial capacity-building needs assessment<sup>3</sup> and PP mapping activity<sup>4</sup> conducted at the beginning of the Project, the CMEP team has designed a number of responsive and relevant capacity-building mechanisms (training, refresher training, supervision, on-the-job training, coaching/mentoring, meetings, and workshops). Capacity-building efforts represent a hallmark achievement of the Project and have contributed to improved malaria care and treatment, higher-quality malaria diagnosis, and better case management. The Project has trained 771 health facility staff as a result of these efforts.

*CMEP has built the capacity of*

**771**

*HF staff over the life of the*

### *District and Provincial Health Staff*

The Special Working Groups for Malaria Elimination (SWGMEs) at the provincial and district levels are a hallmark of CMEP innovation. The working groups, which began in Year 1 in SPL OD, seek to discuss challenges and achievements in malaria elimination at the provincial and district levels, encourage collaboration and knowledge transfer, and ensure a coordinated malaria elimination effort in Cambodia. These working group meetings (quarterly at the district level and biannually at the provincial level) support coordination among partners in malaria elimination and include members from different sectors, including health and non-health actors from the provincial and district levels, private sector, nongovernmental organizations, and armed forces.

CMEP supported these working group meetings throughout the life of the Project, assisting with the development of agendas, providing technical support, and working closely with colleagues at CNM and PHDs as well as ODs. Over the life of the Project, CMEP provided technical support to 91 provincial and district-level working group meetings. The meetings focused on updates to the malaria situation, intervention activities, challenges, solutions, and recommendations for future improvement. Meeting members, especially local authorities, were engaged to support access to hard-to-reach and at-risk areas.

*CMEP has supported*

**91**

*provincial and district-level  
elimination working group  
meetings*

<sup>3</sup> In April of FY2017, CMEP conducted a management-capacity-strengthening needs assessment in target ODs. The plan was finalized and endorsed by the USAID Mission on July 27, 2017.

<sup>4</sup> PP mapping report, accepted by the USAID Mission on July 21, 2017.

## VMWs

VMWs play an essential role in malaria elimination efforts in Cambodia. CMEP has engaged VMWs since the beginning of the Project to build and upgrade their capacity and has organized monthly meetings to review progress and provide on-site mentoring on early malaria diagnosis, treatment, interpersonal communication, LLIN distribution, and case management. Even in light of the COVID-19 pandemic in Years 4 and 5, VMWs continued to serve their communities and report their progress virtually and in a decentralized manner. Over the course of implementation, monthly VMW meetings were attended by a cumulative 13,870 VMWs.

## PPs

CMEP provided extensive support to PPs in Years 1 and 2 of Project implementation before enforcement of the Ministry of Health (MOH) Prakas took effect on April 13, 2018, and restricted PP malaria testing and treatment. (A Prakas is an official Cambodian proclamation issued by the relevant minister.) Following these restrictions, the Project continued to provide relevant information to operating providers (i.e., VMWs and HF staff) during normal supervision and quarterly meetings, explaining how to work with PPs, encouraging them to refer all suspected malaria patients to HFs/VMWs, and providing education on malaria prevention and proper care seeking. In Years 1 and 2, CMEP provided training on malaria case management and early diagnosis and treatment (EDAT), reporting, and referral. Additionally, CMEP conducted quarterly supervision visits to all PPs within the public-private mix (PPM) network to observe practices after initial trainings and to provide on-site performance reviews and mentoring. This support reached over 330 PPs.

## C. Strengthening Early Malaria Diagnosis and Treatment

Throughout the life of the Project, CMEP advocated for high-quality malaria diagnosis and treatment and for improved EDAT implementation among HFs and VMWs/MMWs. VMWs/MMWs made a significant impact on case finding in the CMEP catchment area (seven elimination ODs), testing 119,349 people suspected to have malaria over the life of the Project (Figure 3). Compared to the 73,548 suspected cases tested by HF and PP staff, the VMW contribution to testing and malaria detection illustrates the impact of these community-based workers in advancing efforts toward malaria elimination. Malaria testing at public HFs remarkably decreased during Year 5 due to the COVID-19 pandemic and related response activities that demanded the time of most HF staff.

*CMEP has hosted monthly meetings for a cumulative*

**13,870**

*VMWs over the life of the Project*

*VMWs under CMEP support tested*

**119,349**

*suspected malaria cases using best practices learned through CMEP EDAT capacity-building*

Testing by Provider Type, 2017-2021

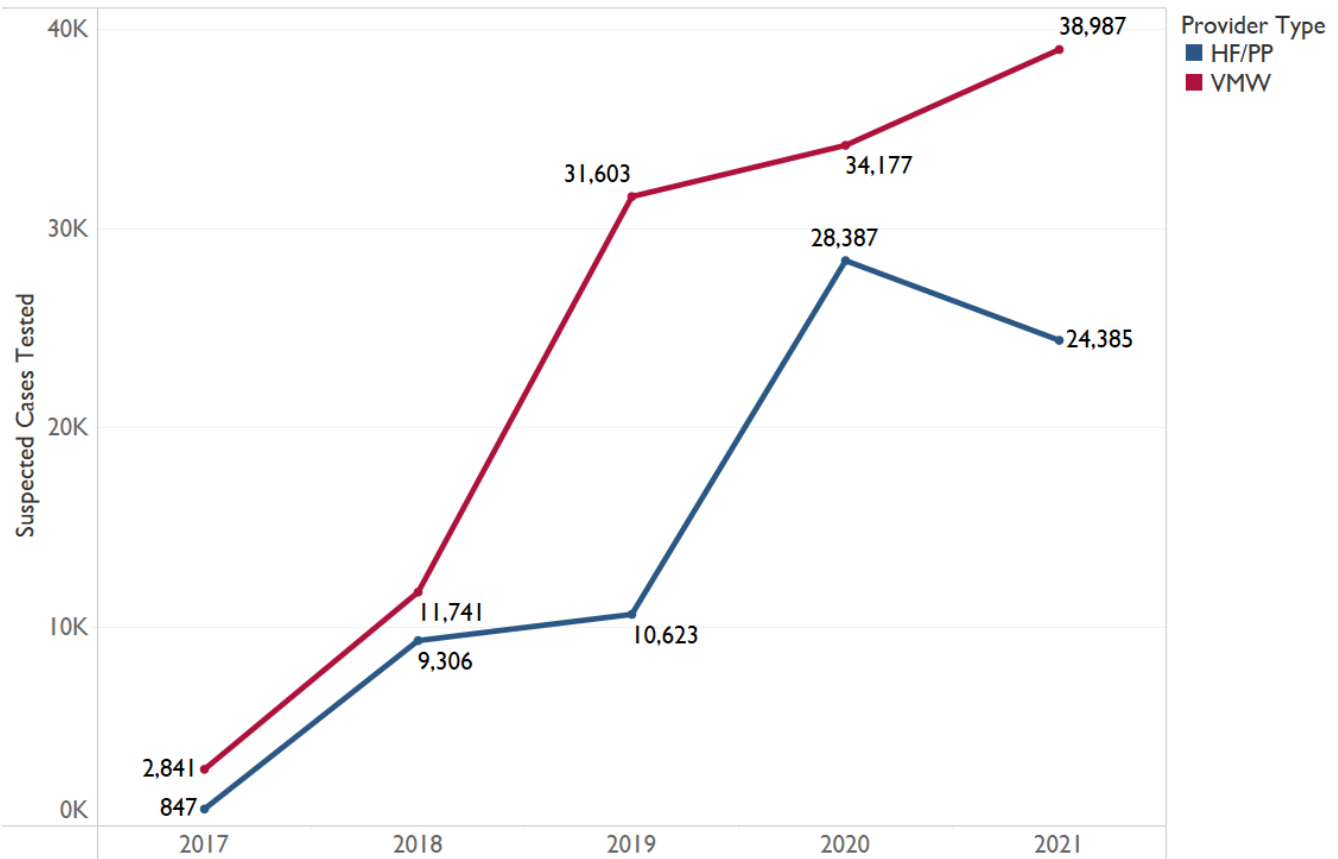


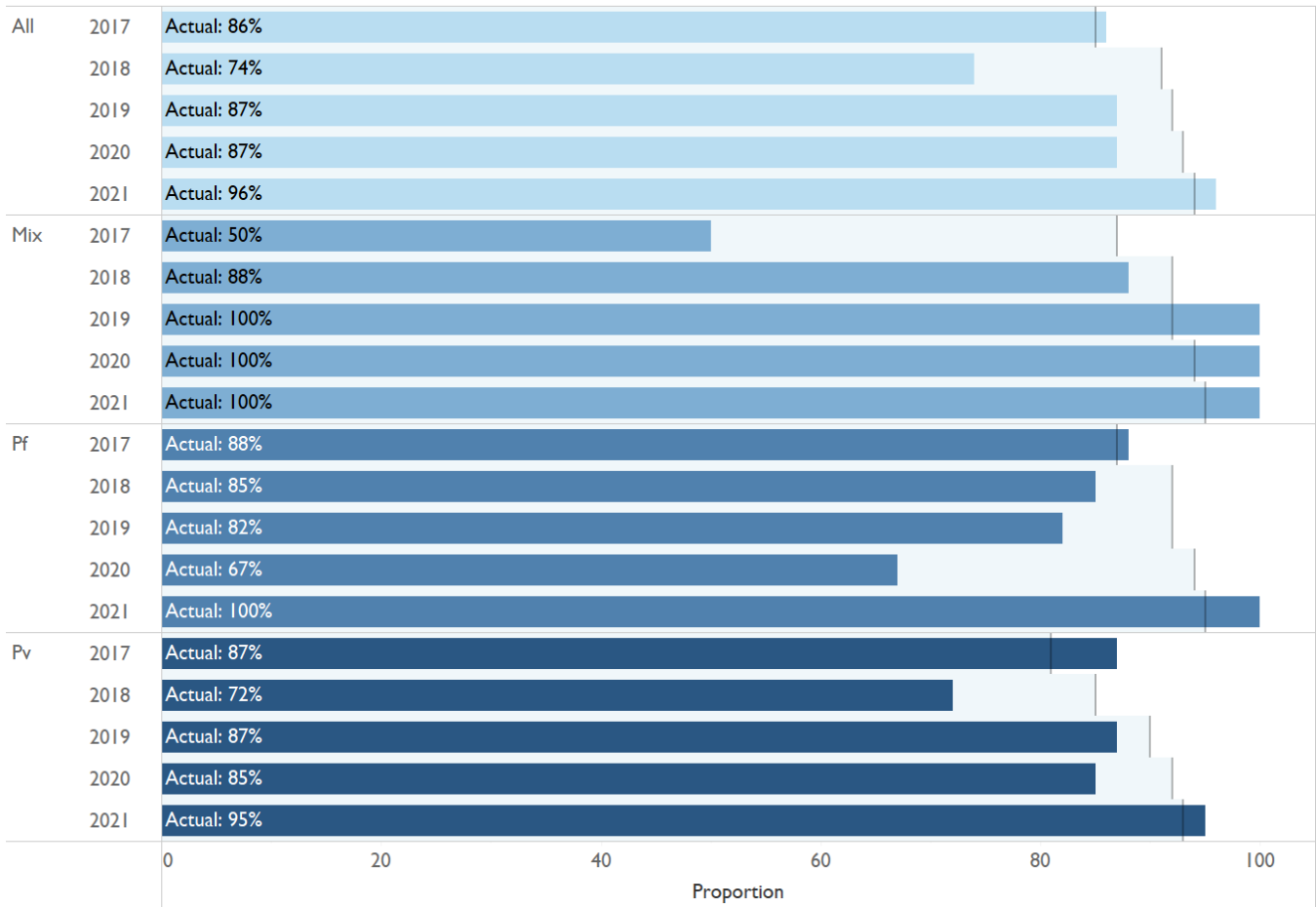
Figure 3: Testing by Provider Type, 2017-2021

#### Directly Observed Therapy Implementation

DOT implementation under CMEP has generally improved over the life of the Project (Figure 4). Some challenges in DOT implementation consistently arose during the Project. One example is that people did not always appear at their assigned HF for three days of DOT due to work or travel commitments. Second, denominator bias was a challenge in which the number of cases was very low, so the proportion of people participating in DOT appeared to be low. Third, some people traveled from other provinces or districts to seek care from VMWs or HF staff and subsequently returned to their homes before DOT completion.

Despite these persistent challenges due to geography, patient mobility, and seasonal weather, the CMEP team worked consistently with HF staff and VMWs to improve DOT completion. Efforts included interpersonal counseling and phone communication while on treatment, as well as a 28-day follow-up for *Pf*/mix cases. Notably, throughout the life of the Project, it was consistently observed that the current first-line treatment for *Pf*/mix (artesunate-mefloquine or ASMQ) remained effective in treating these *Pf*/mix cases in CMEP elimination ODs.

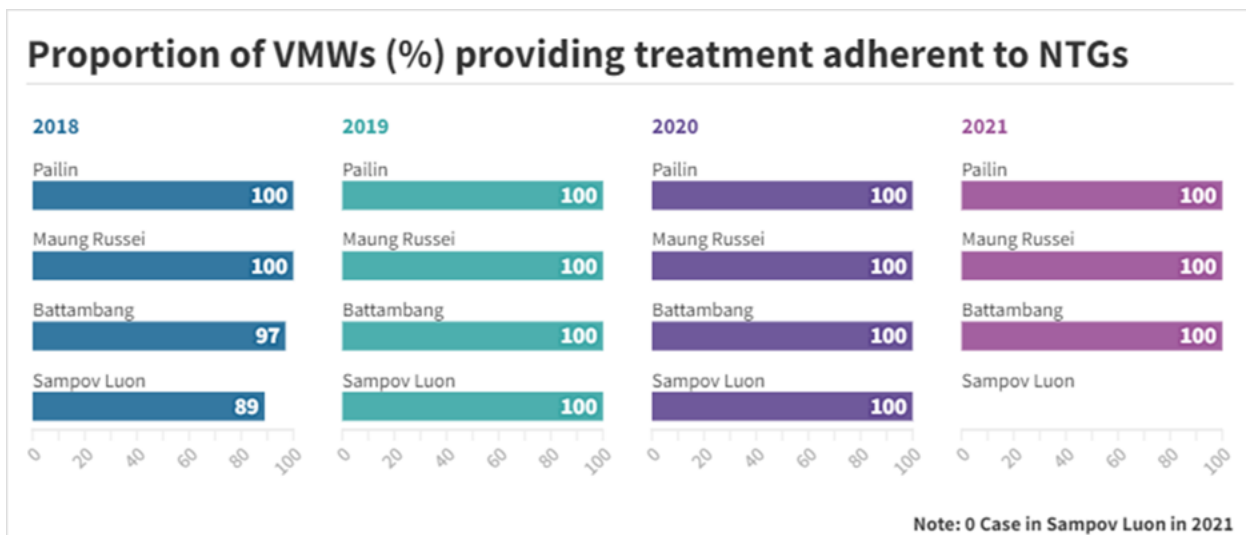
**DOT Coverage, 2017 to 2021**



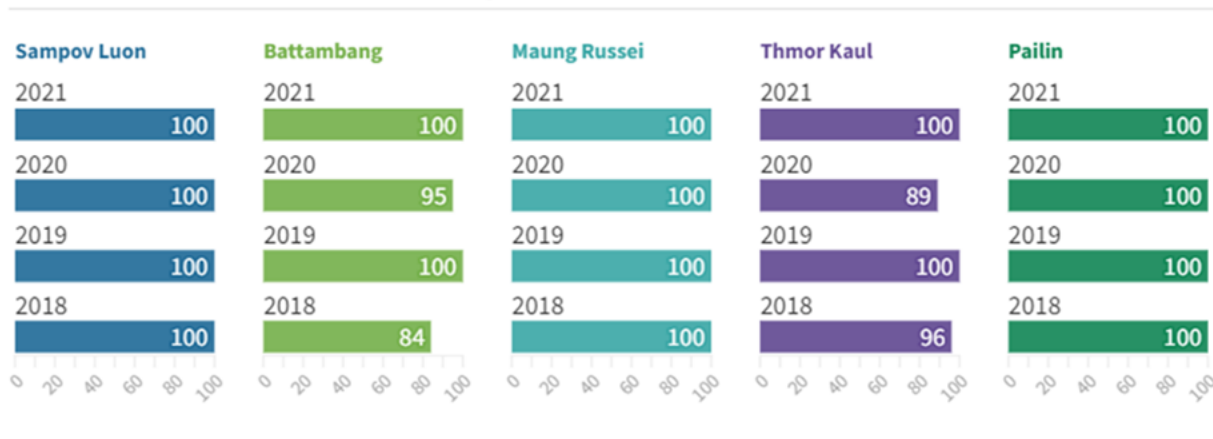
**Figure 4: DOT Coverage, 2017-2021**

*Alignment with NTGs*

Alignment with NTGs was always high in elimination ODs, especially in Battambang and Pailin provinces (See graphs below) with all reached 100% at late years of the project both cases treated by VMWs and cases treated at HFs.



## Proportion of HF's (%) providing treatment adherent to NTGs



### *Implementing Single Low-Dose Primaquine for Pf Malaria*

Single low-dose primaquine (SLDPQ) for blockage of *Pf* transmission represents an important innovation in malaria treatment in Cambodia. CMEP, in collaboration with CNM, developed job aids, orientation trainings, and other capacity-building activities to support the rollout of this important treatment option. Implementation began in CMEP areas in 2017 and was subsequently expanded to the entire country from 2018 onward. Since these initial efforts, CMEP has maintained capacity-building and monitoring efforts to support the high-quality implementation of SLDPQ as a treatment option in Cambodia. CMEP efforts have led to the treatment of *Pf*/mix malaria with SLDPQ and associated adverse event monitoring in CMEP elimination ODs.

### *Preventing Stock-Outs of Artemisinin-Based Combination Therapies and RDTs*

In addition to capacity-building efforts that encouraged HF's and ODs to perform tasks to ensure adequate supply and proper stock management, CMEP also supported activities to strengthen the supply chain to prevent stock-outs of artemisinin-based combination therapies (ACT) and RDTs at the facility level, to forecast the potential for stock-outs, and to take immediate action to fortify stocks, redistribute ACT and RDTs locally where indicated, and prevent future potential stock-outs from occurring. CMEP managed stock monitoring status for ACT and RDTs, alerting relevant points of care (POCs) when stock-outs were possible. CMEP also reallocated commodities from nearby POCs with supplemental stock to POCs with low stock and managed requests for additional commodities from the central level. By Year 5, among the 107 facilities in seven elimination ODs, there were **zero** stock-outs reported for either ACT or RDTs.

## D. Implementing the 1-3-7 Malaria Surveillance Model

### *Model Implementation*

The 1-3-7 model for malaria elimination is a hallmark of the CMEP strategy for interrupting local malaria transmission and reducing the malaria burden overall. The model, which was first implemented in Cambodia in SPL OD, has been implemented in seven CMEP-led elimination ODs and five additional ODs that received CMEP technical assistance for implementation.

The 1-3-7 activities seek to achieve the following for all malaria cases in the implementation area:

- Notify cases within one day (using an SMS alert system).
- Investigate and classify cases within three days along with reactive case detection (malaria screening/testing, assessing/topping up LLINs, and providing face-to-face health education through interpersonal communication).
- Conduct foci investigation within seven days (not later than 14 days) and foci management (follow-up for 12 months for any active foci).



CMEP has successfully implemented the 1-3-7 approach throughout the life of the Project, as shown in Figure 5.

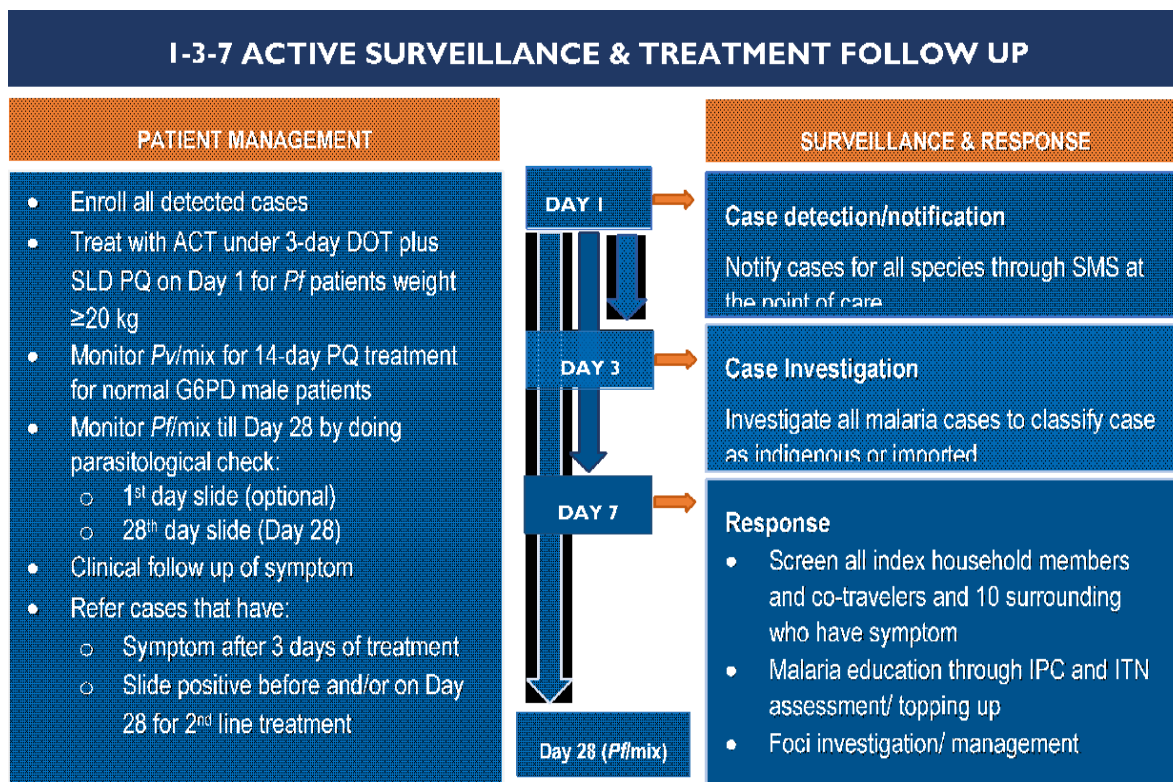
### 1-3-7 Achievement over Time

	1	3	7
2017	100%	100%	100%
2018	69%	59%	100%
2019	87%	84%	100%
2020	90%	85%	100%
2021	99%	98%	100%

**Figure 5: 1-3-7 Achievement Over Time**

Additionally, CMEP has often conducted the 1-3-7 approach more quickly than required, working toward a 1-1-1 or 1-2-2 or 1-3-3 model in some cases. In Year 1, 97% of cases followed a 1-2-2 timeline. Similarly, 59% of cases followed a 1-2-2 approach in Year 2, 84% in Year 3, and 43% in Year 4. In Year 5, 17% of cases followed a 1-1-1 timeline, 35% followed 1-2-2, and 36% followed 1-3-3; the rest (12%) followed 1-3-7. In Year 2 (2018) and Year 3 (2019), the completed notification within one day and response within 3 days were low due to the expansion/scale up of ODs applying the 1-3-7 approaches that were challenging at the beginning but improving over the years.

The 1-3-7 strategy includes both patient management and surveillance and response aspects. These components are described in detail in Figure 6.



**Figure 6: The 1-3-7 Model Explained**

### Case Classification and Foci Investigation

Case classification helps identify the source of detected malaria cases and assists in providing the appropriate response package in the correct place in a timely manner. CMEP supported case investigation/classification and foci investigation efforts throughout the life of the Project as an integrated element of the 1-3-7 model. After initially leading and directing implementation, CMEP assisted HF and OD staff with investigation and response following approved SOPs, ensured the accurate entry of collected data into the appropriate system, and provided financial and logistical support for investigation and response activities. During the implementation period, important considerations were integrated into the model, such as reactive case detection, systematic screening among family members, co-travelers of index cases, and selective screening among surrounding household members based on symptoms. Foci investigations are inherent to the 1-3-7 approach: upon the identification of an L1 *Pf*/mix case, a focus investigation is initiated within seven days of the initial notification and no later than 14 days after the case has been classified. Figure 7 summarizes case classification efforts from FY2018 onward in CMEP elimination ODs. Notably, SPL OD has only reported L4 cases and cases imported from Thailand since the start of CMEP and is thus excluded from this figure.

Case Classification, 2018-2021

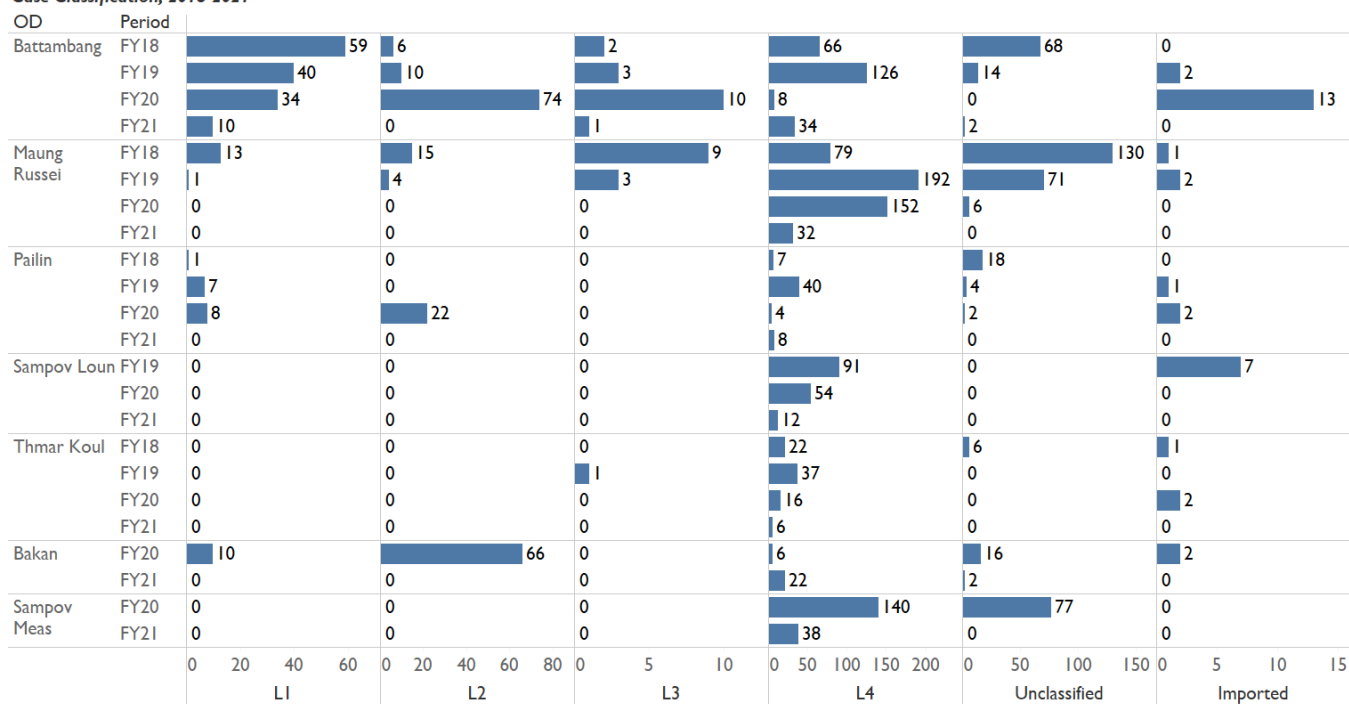


Figure 7: Case Classification, 2016-2021 (Excluding SPL OD)

## E. Improving Coverage of Malaria Prevention Interventions

### *LLIN Distribution*

LLINs are an essential component of malaria elimination efforts in Cambodia. Throughout the life of the Project, CMEP facilitated the distribution of 183,616 in the Project catchment area, inclusive of mass distribution and top-up distribution efforts. These efforts were always paired with education and information distribution to ensure the effective use of LLINs and to support malaria prevention behaviors. They covered a cumulative 852 villages over the life of the Project and included 36,061 monitoring visits to ensure the correct use of LLINs and to replenish the LLIN supply when indicated. Monitoring visits also included testing individuals who had malaria symptoms and sharing interpersonal communication messaging to integrate net distribution with knowledge transfer at the community level. VMWs were essential to the efforts' success, distributing LLINs and providing essential monitoring and counseling visits after the CMEP-delivered capacity building and training on LLIN distribution, monitoring, and counseling.

### *SBCC*

SBCC is integral to the CMEP malaria elimination strategy. In consultation with CNM, CMEP developed and produced different SBCC materials to support all malaria prevention and treatment services, not limited to the development and production of leaflets, flip charts, booklets, banners, and billboards. VMWs capacitated by CMEP delivered IPC messaging to 654,724 household representatives, patients tested for malaria, and mobile and migrant populations (MMPs) over the life of the Project. Household representatives were targeted as influential members of the community who could be capacitated to change malaria risk behaviors and ensure high LLIN usage. Additionally, after providing malaria tests, VMWs provided health education messaging to integrate prevention and detection efforts. Finally, MMPs were engaged in farming communities to describe malaria risk behaviors, share ways to reduce malaria risk, and provide LLINs. This monumental effort signifies community-led knowledge dissemination for malaria prevention awareness and health education generally.

In addition to these direct IPC efforts, CMEP supported the Battambang PHD in producing and broadcasting public service announcements (PSAs) during Years 2 and 3 of the Project. These PSAs were targeted to at-risk populations who would benefit from malaria prevention information and provided details on how to seek malaria testing and treatment during peak malaria transmission seasons. After a reduction in the number of malaria cases in Battambang, the PSAs were discontinued in January 2019.

In Year 3 of the Project, CMEP staff conducted an SBCC assessment in four CMEP ODs: BTB, KRK, MRS, and PKV. A total of 110 respondents (10 of whom were MMPs) were randomly selected for an interview to discuss preferences in IPC delivery, understand IPC's influence on risk behaviors, and guide further IPC implementation. Results from this assessment confirmed that face-to-face communication and other IPC strategies played a key role in delivering malaria messages to CMEP target populations and influenced malaria risk behaviors in at-risk populations. This assessment led to further targeting of IPC activities to those at high risk for malaria acquisition.

*CMEP support facilitated the distribution of*

**183,616**

*LLINs,*

**36,061**

*monitoring visits, and IPC messaging to*

**654,724**

*household representatives, tested patients, and mobile/migrant populations over the life of the Project*

## F. Supporting CSOs and Community-Based Organizations to Implement Interventions to Transition Toward Malaria Elimination

CMEP supported three CSOs and community-based organizations (CBOs) to improve coverage of malaria prevention, detection, and treatment services among hard-to-reach groups. In these Grants Under Contract — selected under a competitive process in which the selection committee of CMEP and CNM representatives chose groups with sufficient capacity to implement malaria services — CMEP also provided technical support for local organizations’ further capacity building. These support activities included improving the quality of implementation, mainstreaming gender in program implementation, improving branding and marking, measuring project monitoring indicators, reporting, and financial management. These ongoing efforts served to improve the capacity of local CSOs and the quality of malaria services available at the community level in Cambodia. CMEP engaged the three organizations described in the following three subsections over the life of Project. (Due to poor performance and financial misconduct, the contract with Operation Enfant du Cambodge [OEC] was ended in late 2019.)

### AHEAD

AHEAD was the first CSO selected under the CMEP small grants program in Year 2. AHEAD worked primarily with HF staff to organize educational campaigns and promote behavior change for malaria prevention among MMPs. Activities also included mapping worker settlements and other at-risk populations, including ethnic minority groups, to ensure malaria prevention and treatment services are available to these populations. AHEAD worked in LLIN distribution, the referral of suspected malaria patients, and the follow-up and tracking of malaria burden in the catchment area. Finally, the organization cooperated with VMWs in the area to facilitate testing, referrals, and treatment. AHEAD worked in 27 remote administrative villages and 44 annex villages in four CMEP elimination ODs (BTB, TMK, SPL, and PLN) over the life of the contract. A full summary of AHEAD performance results from Years 2 to 5 is provided in Table 1.

**Table 1: AHEAD Performance Results, Project Years 2 to 5**

Indicators	Year				Total
	FY2018	FY2019	FY2020	FY2021	
1. # of health education campaigns organized in high-transmission villages	136	334	400	150	<b>1,076</b>
2. # of mobile/migrant and new settlers reached with behavior change communication (BCC) messages through IPC	4,406	11,056	12,835	4,577	<b>34,192</b>
3. # of LLINs distributed to mobile/migrant population	3,267	4,081	11,342	4,644	<b>25,690</b>
4. # of mobile/migrant settlements mapped	348	520	484	219	<b>1,624</b>
5. # of suspected malaria patients referred to VMWs/HFs	740	918	1,336	738	<b>3,916</b>
6. # of patients seeking treatment at VMWs/HFs (referred as suspected cases and reached VMWs/HFs)	738	917	1,341	738	<b>3,918</b>
7. # of reports on any increased malaria cases or outbreaks	7	2	-	-	<b>9</b>
8.# of meetings organized with ODs and PHDs	10	8	15	6	<b>49</b>
9. # of government meetings attended by CSOs (Provincial Technical Working Group for Health [Pro-TWGH] meetings)	10	30	33	22	<b>105</b>

## PFDA

PFDA began working under CMEP in Year 2 under a similar scope of work to AHEAD's scope. PFDA worked in two elimination ODs (SPM and BKN) and two transitional elimination ODs (KRK and PKV) of the Pursat Province, covering nine administrative villages and 92 annex villages. A full summary of PFDA performance results from Years 2 to 5 is provided in Table 2.

**Table 2: PFDA Performance Results, Project Years 2 to 5**

Indicators	Year				Total
	FY2018	FY2019	FY2020	FY2021	
1. # of health education campaigns organized in high-transmission villages	343	724	332	130	<b>1,529</b>
2. # of mobile/migrant and new settlers reached with BCC messages through IPC	4,623	10,374	7,691	3,162	<b>25,850</b>
3. # of LLINs distributed to mobile/migrant population	4,115	11,952	10,155	2,627	<b>28,849</b>
4. # of mobile/migrant settlements mapped	86	82	246	130	<b>544</b>
5. # of suspected malaria patients referred to VMWs/HFs	902	2,140	1,773	2,298	<b>7,113</b>
6. # of patients seeking treatment at VMWs/HFs (referred as suspected cases and reached VMWs/HFs)		2,140	1,773	2,298	<b>6,211</b>
7. # of reports on any increased malaria cases or outbreaks		-	-	-	-
8. # of meetings organized with ODs and PHDs		17	10	2	<b>29</b>
9. # of government meetings attended by CSOs (Pro-TWGH meetings)		31	61	40	<b>132</b>

## OEC

OEC worked under CMEP in Year 3 with a similar scope of work to those of AHEAD and PFDA. OEC worked in one CMEP OD (MRS) and in 15 annex villages in MRS OD, having demonstrated a willingness to collaborate with OD counterparts and CMEP OD teams to plan, implement, and monitor progress. OEC ended its working contract with CMEP at the end of Year 3. A full summary of OEC performance results in Year 3 is provided in Table 3.

**Table 3: OEC Performance Results, Project Year 3**

Indicators	Q1	Q2	Q3	Q4	Total
1. # of health education campaigns organized in high-transmission villages	0	23	17	16	<b>56</b>
2. # of mobile/migrant and new settlers reached with BCC messages through IPC	0	696	305	317	<b>1,318</b>
3. # of LLINs distributed to mobile/migrant population	0	1,409	563	384	<b>2,356</b>
4. # of mobile/migrant settlements mapped	0	22	17	14	<b>53</b>

Indicators	Q1	Q2	Q3	Q4	Total
5. # of suspected malaria patients referred to VMWs/HFs	0	88	43	53	<b>184</b>
6. # of patients seeking treatment at VMWs/HFs (referred as suspected cases and reached VMWs/HFs)	0	88	43	53	<b>184</b>
7. # of reports on any increased malaria cases or outbreaks	0	0	0	0	<b>0</b>
8. # of meetings organized with ODs and PHDs	0	4	3	3	<b>10</b>
9. # of government meetings attended by CSOs (Pro-TWGH meetings)	0	4	3	3	<b>10</b>

## G. Operational Research Activities

CMEP has engaged with PMI and USAID in proposing an operational research agenda, discussing research priorities, and implementing operational research activities throughout the life of the Project. In Year 1, CMEP consulted with PMI and USAID on research priorities and subsequently held technical meetings with CNM, WHO, and other partners to finalize an operational research agenda and to identify opportunities for CMEP to lead operational research studies. After discussions with stakeholders and partners, CMEP, in collaboration with the Institut Pasteur in Cambodia, designed and implemented an operational research study to evaluate the use of highly sensitive rapid diagnostic tests (hsRDTs) for reactive case detection in Cambodia.

### *hsRDTs for Reactive Case Detection*

CMEP, in collaboration with the Institut Pasteur in Cambodia, began field implementation of the hsRDT study in August 2018. The study aimed to understand the use of a hsRDT compared to a conventional RDT (cRDT) and polymerase chain reaction (PCR; the gold-standard test) in identifying additional asymptomatic cases of malaria in the community. CMEP and the Institut Pasteur of Cambodia trained 61 people from 19 HFs in five ODs on study objectives, protocol design, methodology, questionnaires, informed consent and assent, blood testing with the three tests under study (cRDT, hsRDT, and PCR), sample storage, transportation, and waste management. Data collection began, originally in elimination ODs in Battambang and Pailin Provinces, after approval by the institutional review board of the PMI and U.S. Centers for Disease Control and Prevention (CDC) and the Cambodia National Ethics Committee for Health Research (NECHR). Due to a small available sample size, the study was expanded to include Pursat Province after approval by the CDC/PMI institutional review board and the NECHR. The final sample size included 37 individuals with *Pf* malaria and a further 160 family members, co-travelers, and co-traveling contacts. All 197 participants were screened and tested with four tests: cRDT, two brands of hsRDT (Alere and Global Good), and dried blood spots for PCR testing.

Final results for the hsRDT study were compiled and submitted in July 2020 to the NECHR and CDC. It was reported that hsRDTs are not sensitive in the detection of *Pf* infection among asymptomatic individuals with low parasitemia. Despite this finding, hsRDTs were effective diagnostic tools among symptomatic index patients with sufficient parasitemia. The study also identified a higher risk of malaria transmission among coworkers of index cases as a secondary objective. This finding supports the focal nature of malaria transmission in areas away from the index case's area of residence and the likely association between travel to forested areas and malaria acquisition.

### 3. Objective 2: Support the scale-up of high-quality malaria control and prevention interventions in five to eight ODs, where gaps in coverage or quality exist

CMEP successfully supported the scale-up of high-quality malaria control and prevention interventions in ODs where gaps in coverage or quality exist. In these transitional ODs, where elimination is an eventual focus, CMEP worked to improve the capacity of health care workers (including HF staff and VMWs), scale up prevention and control interventions, and prepare ODs for elimination. By April 2020, the last two transitional ODs (PKV and KRK) in Pursat Province moved to partial malaria elimination, focusing on *Pf*/mix malaria and applying the full package of 1-3-7 strategic approaches. While the COVID-19 pandemic affected the delivery of in-person visits and capacity-building activities to an extent, the CMEP team maintained high coverage of capacity-building and supportive supervision activities under this objective. Individual case management, including *Pv* radical treatment and case-based surveillance, has been very well managed in the two ODs, leading to a drastic reduction in malaria cases in Pursat Province.

#### Objective 2 Achievements

% of suspected malaria cases that received a parasitological test: 100% (Target = 100%)

% of confirmed *Pf*/mixed cases that received the appropriate malaria treatment by VMWs/MMWs under DOT according to the NTGs: 100% (Target = 98%)

% of HFs and VMWs/MMWs that received structured supervision and feedback on malaria at least twice in the last three years: 81% (Target = 85%)

#### A. Initial Situational Analysis and Planning

##### *Situational Analysis*

CMEP conducted a comprehensive situational analysis of extant malaria control operations in **five transitional ODs (BTB, TMK, PVK, KRK, and MRS)** in 2017 to inform program implementation for the life of the Project. An additional assessment was conducted in 2018 for **two additional transitional ODs (BKN, SPM)**. These assessments elucidated gaps in the provision of malaria prevention, diagnosis, and treatment and considered factors like service delivery infrastructure, availability of human resources, access to essential malaria commodities, and management structures for effective leadership and governance.

CMEP identified challenges in most or all transitional ODs. Challenges included the interruption of the PPM program, VMW and MMW activities supported by the Global Fund, lack of malaria educational materials, difficulties in providing malaria commodities in the PPM program, and lack of LLIN coverage data in some locations. This assessment also elucidated priority areas for capacity building for HCWs engaged in malaria service delivery, including case management per national treatment guidelines (NTGs) and the use of SLDPQ. Additional training needs included M&E and program management at the OD and HF levels.

The results of these assessments guided program implementation throughout the Project and were considered during the development of AOPs and work plans.

##### *PP Mapping*

CMEP conducted PP mapping in Years 1 and 2 of Project implementation to define realistic targets and monitoring strategies. This work occurred before the MOH Prakas released in April 2018 restricted PPs' malaria testing and treatment. PP mapping in Year 1 included those in BTB, TMK, PVK, KRK, and MRS. And mapping in Year 2 included PPs in BKN and SPM. As of Year 2, the number of active PPs in the CMEP transitional ODs was **139** (SPM: 25, BKN: 46, KRK: 38, KRV: 30), and in Year 5, it was **60** (KRK: 35, PKV: 25).

## B. Capacity Building

### *Improving the Quality of Malaria Diagnosis and Treatment Services*

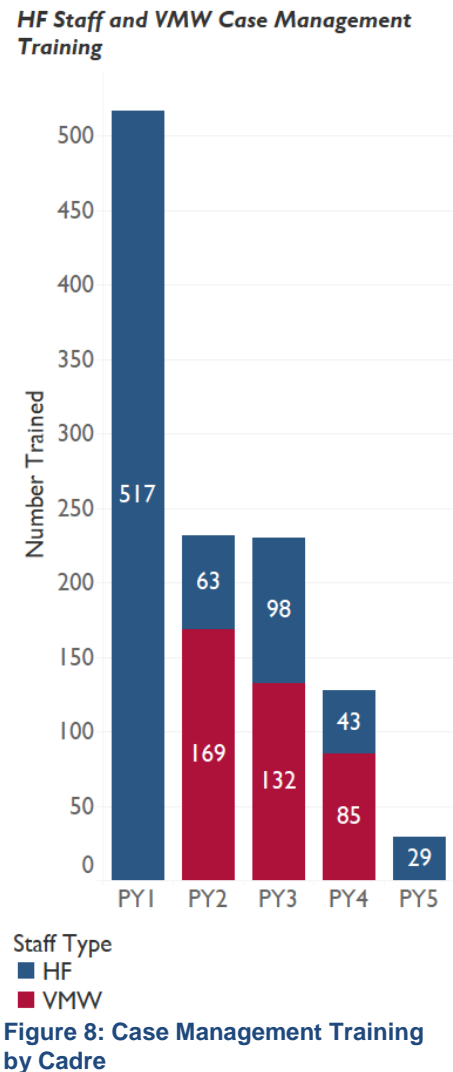
CMEP has conducted activities in Project ODs to improve the quality of malaria diagnosis and treatment services throughout the life of the Project. CMEP provided technical assistance, including regular meetings as well as training and refresher training on malaria case management, surveillance and reporting systems, supportive supervision, on-the-job training, and supply monitoring. This assistance was provided to 1,813 malaria service delivery units over the life of the Project, including 304 HFs, 359 PPs, and 1,428 VMWs. These capacity-building activities aligned with the CMEP capacity development plan. All service delivery units or POCs, except PPs after the 2018 MOH Prakas, conducted EDAT in their catchment area through both passive case detection and active case detection, provided treatment according to NTGs, and followed up with treated case(s) through to completion.

### *VMW and MMW Meetings*

CMEP continued holding monthly meetings for VMWs and MMWs, leveraging success from the URC-implemented USAID/PMI CAP-Malaria Project and successfully expanding the concept to additional CMEP ODs. VMW meetings were used to report information on new malaria cases; to receive RDT/ACT supplies from HF staff; to receive on-the-job training for case management (including SBCC topics), case registration and reporting, LLIN monitoring, and topping-up reports; and to share challenges encountered during the past month. The meetings were well attended throughout the life of Project, with **8,982** cumulative VMWs attending.

### *Malaria Case Management Training*

CMEP has provided continuous technical assistance to HF staff and VMWs on malaria case management aligned to national guidelines. Over the life of the Project, CMEP trained 750 HF staff and 386 VMW staff on malaria case management (Figure 8).



**Figure 8: Case Management Training by Cadre**

## C. Strengthening Early Malaria Diagnosis and Treatment

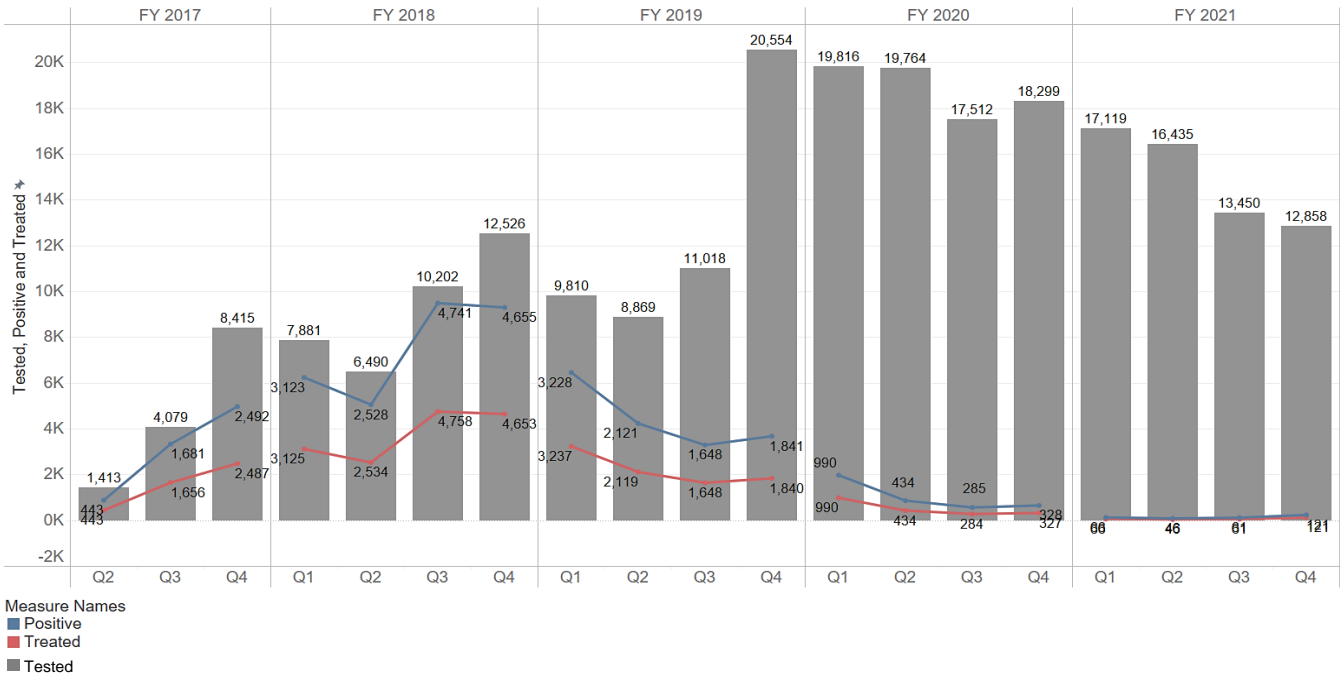
CMEP delivered intensive capacity building and technical assistance throughout the life of the Project to improve early malaria diagnosis and treatment in elimination and transitional ODs. Starting with five transitional and elimination ODs at the beginning of implementation, CMEP ended with two transitional ODs (both in Pursat Province), both of which were given “pre-elimination” programming in terms of introducing the elimination activity package (active surveillance and response as well as ongoing follow-up) to highlight the progress made toward the *Pf* malaria elimination status in the Project catchment area.

### *Testing and Case Finding*

CMEP-trained HF staff, VMWs, and MMWs tested over 99% of all suspected malaria cases with a parasitological test over the life of the Project, meeting the 100% target in Years 2, 3, and 5 and achieving 99.3% and 99.6% in Years 1 and 4, respectively. Over the life of the Project, CMEP supported the administration of 246,131 tests by RDT, confirmation of 31,719 positive cases, and treatment initiation for 30,829 confirmed malaria cases (summarized in Figure 9). In addition to this capacity-building support, CMEP jointly conducted supportive supervision with OD, PHD, and CNM staff.



**Testing and Treatment**



**Figure 9: Testing and Treatment Cascade by Quarter, FY2017-FY2021**

*Treatment*

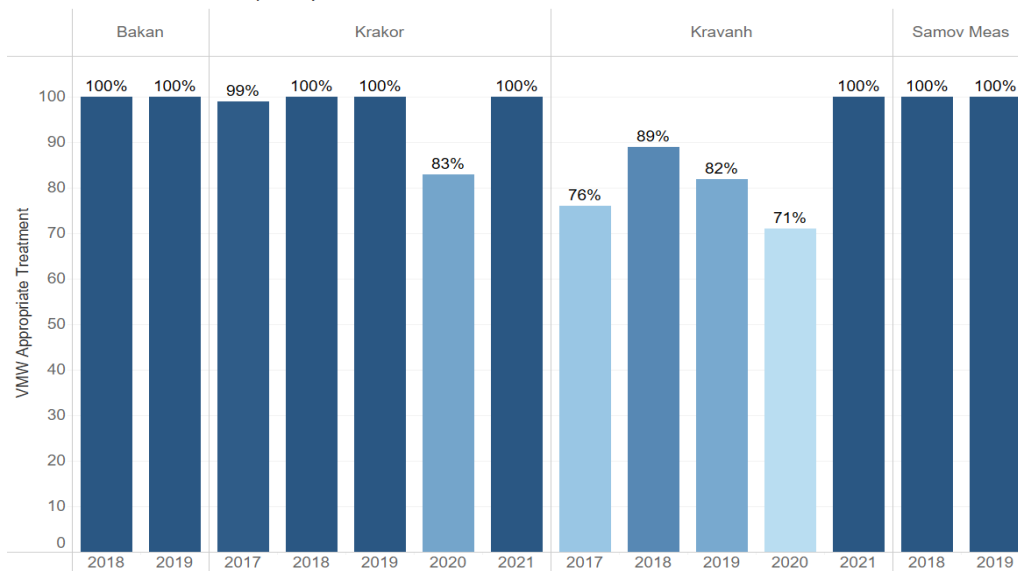
**DOT**

Adherence to DOT was generally high, with 87.4% of *Pf*/mixed cases receiving DOT as indicated. VMWs and HF staff provided DOT through CMEP support, which included financial and logistical support, throughout the life of the Project.

**Alignment with NTGs**

Alignment with NTGs was generally high in transitional ODs, with about 93% of all cases treated by VMWs given treatment adherent to NTGs. Among cases treated at HFs, 97% were given treatment adherent to NTGs, as shown in Figure 10.

*Treatment Adherent to NTGs (VMWs)*



**Figure 10: Proportion of Treatment Provided by VMWs Adherent to NTGs**

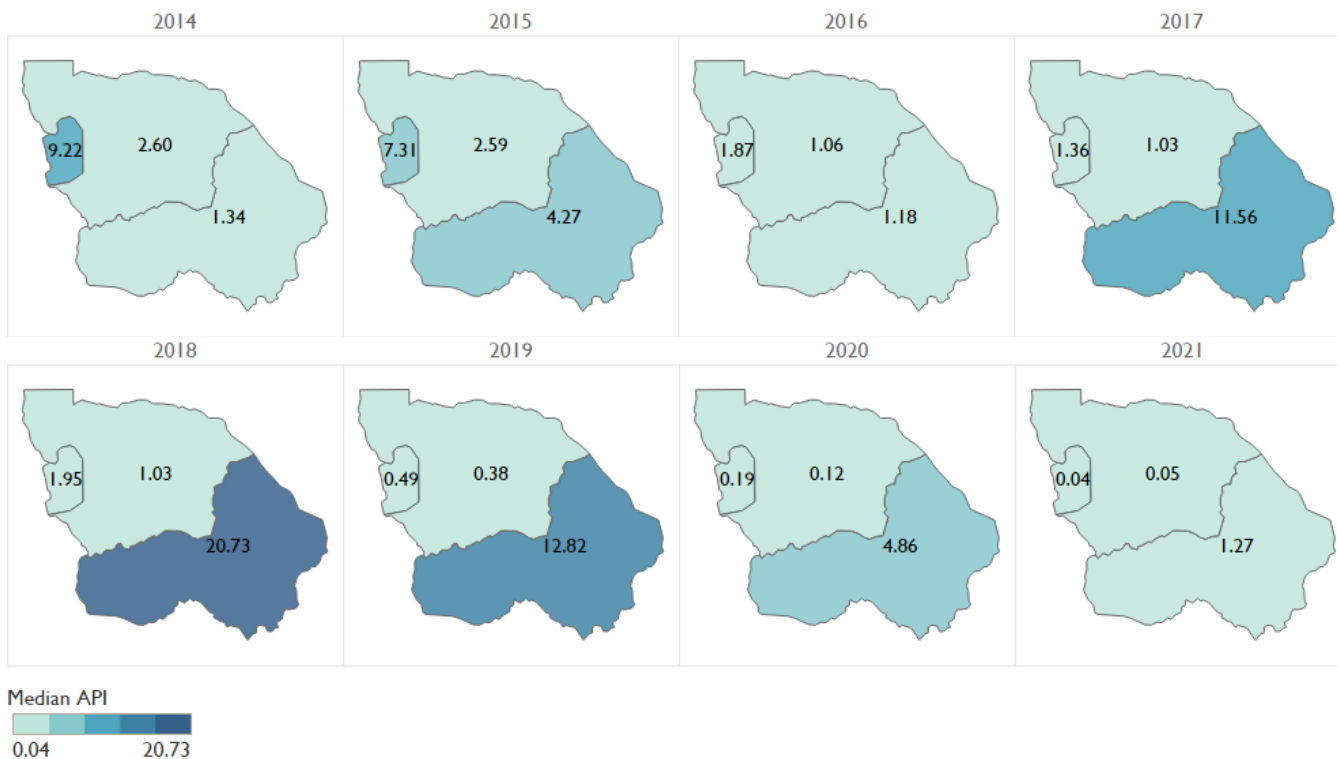
## Use of SLDPQ in Transitional ODs

CMEP supported the roll-out of SLDPQ treatment in target ODs during the life of the Project. Year 1 activities included developing job aids and training materials based on CNM best practices. Additionally, small-scale implementation in SPL OD began in Year 1. In the following years, CMEP rolled out SLDPQ to all target ODs.

### *Managing OD-Level Outbreaks in Pursat Province*

A significant increase in malaria cases was observed in Pursat Province (in KRK and PKV ODs) from the beginning of CMEP implementation. To mitigate this increase, the CMEP team mobilized to identify health facilities and hotspots for investigation and response, inclusive of a total of 21 villages in seven HF catchment areas between the two ODs. Additional interventions were intensified, including ITN distribution and top-up, health education with IPC, SBCC material distribution, and mass screening and treatment activities. Starting in Year 3, the CMEP response to this increase in cases aligned with the first CNM intensification plan (IP-1), which was introduced in September 2018, and subsequently, the second CNM intensification plan (IP-2) introduced in 2019. This response included the establishment of MMWs in identified hotspots, proactive interventions with frequent MMW outreach to search for at-risk populations (mostly forest goers, workers, and MMPs), and the provision of malaria prevention and treatment services to at-risk populations.

### **API, FY 2014 to FY 2021**



## D. Improving the Coverage of Malaria Prevention Interventions

### *LLIN Distribution, Monitoring, and Top-Up*

CMEP supported universal LLIN distribution throughout the life of the Project, including mass distribution, buffer stock for replacement LLINs, and top-up distribution as needed. VMWs served as a local point of contact for LLIN distribution — VMWs kept buffer LLIN stocks in their homes for more proximal distribution as needed.

To ensure the continued use of high-quality, functional LLINs, the CMEP VMWs conducted LLIN monitoring and top-up visits, achieving a total of **21,225** visits.

### *SBCC Interventions*

CMEP conducted a broad range of SBCC interventions over the life of the Project, contributing to improved malaria prevention in the Project catchment area. SBCC interventions included integrated IPC during LLIN distribution and top-up, engagement of household representatives in malaria prevention through targeted IPC, MMP-specific IPC for improved coverage of prevention services in hard-to-reach populations, job aids, and health education interventions, including a public radio show.

### **Integrated IPC**

CMEP conducted mass screening events for malaria in Year 1. After observing low yield, the Project shifted focus to provide targeted IPC and screening activities based on geographic and other risk factors. CMEP provided IPC during LLIN distribution and top-up, engaged household representatives in IPC messaging, and provided MMP-specific IPC for people moving to or working in malaria zones. Additionally, CMEP supported the provision of IPC to suspected malaria patients who were tested for malaria by health care providers, including HF staff, PPs, and VMWs. Overall, **24,910** people received IPC through this method. Additionally, **235,962** people received IPC through LLIN distribution and top-up, **168,815** through household representative visits, and **20,656** through MMP-specific IPC efforts.

### **Health Education and Mass Media**

CMEP VMWs provided health education along with integrated IPC during home visits, LLIN distribution, and malaria screening and testing activities. These activities were guided by VMW job aids and posters to increase awareness of the benefits of using LLINs in forested areas, to increase testing uptake, and to improve malaria treatment adherence. In addition to these targeted activities, CMEP produced a radio call-in show in Pursat Province. The show helped raise malaria awareness among the public to increase knowledge about malaria prevention, health care seeking, and treatment adherence. CMEP also supported the production of public service announcements (PSA) in Pursat in collaboration with the Pursat PHD. The show was assessed in Year 3 of Project implementation among 320 households in malaria endemic areas covered by the Project. The assessment found that 13.2% of interviewed households reported listening to the show and that 7.2% of all respondents listen to the radio generally. In light of these findings, the radio show was discontinued in Year 3.

### *Supporting CSOs and CBOs*

CMEP conducted activities to support CSOs and CBOs starting in Year 2 of Project implementation. Project sub-grantees provided malaria services in remote, hard-to-reach areas otherwise isolated from malaria services provided at the HF or by VMWs. These organizations included AHEAD and PFDA. Full performance details for AHEAD, PFDA, and all CSOs/CBOs are described in Objective 1.

*CMEP distributed a combined*

**418,493**

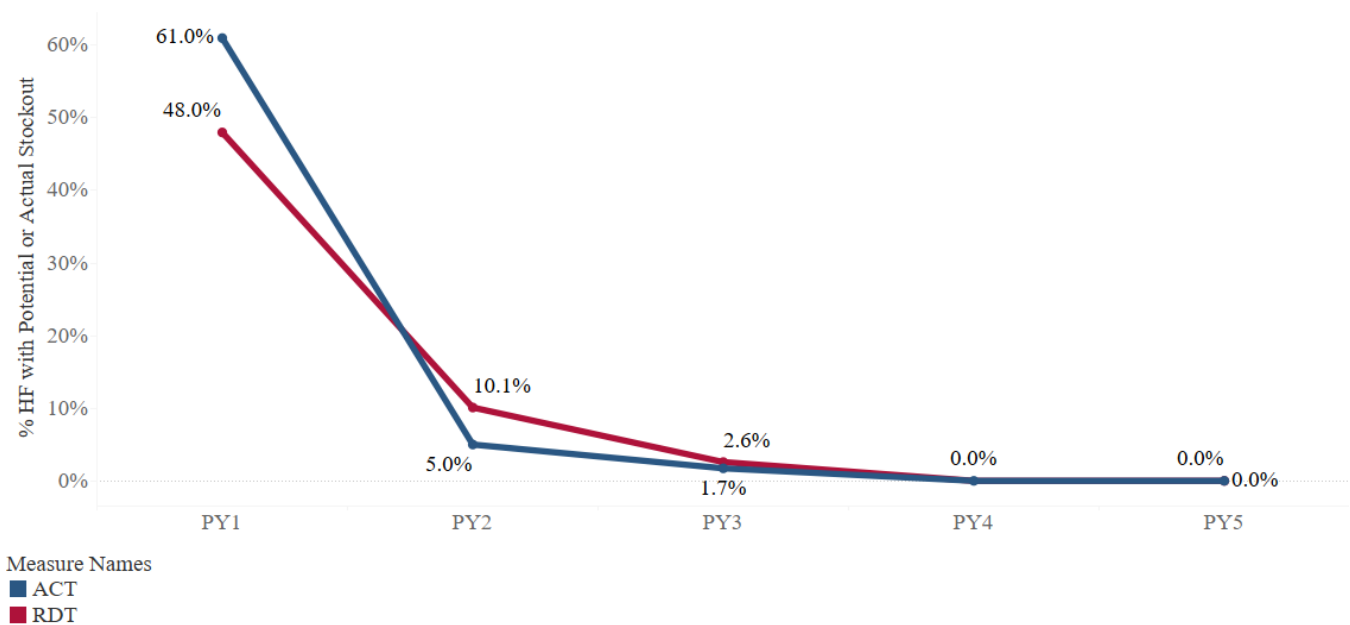
*LLINs to VMWs' homes and directly to villages to support universal LLIN coverage*

## E. Build Capacity and Strengthen Systems to Manage Malaria Control Activities

CMEP provided broad support to supply chain and health system activities to ensure an uninterrupted supply of essential malaria commodities (including RDTs, ACT, and other commodities). Since Year 1, CMEP managed these activities using a mHealth intervention that tracked stock reporting status in the cloud, identifying facilities

with the potential for stock-outs to prioritize support for reallocation from nearby facilities with sufficient stocks. In Year 1, potential ACT stock-out was observed in 30% of facilities, and actual ACT stock-out was observed in 30% of facilities (Figure 11). Similarly, potential RDT stock-out was identified in 34% of facilities, and actual RDT stock-out was observed in 14% of facilities. In comparison, there were no stock-outs observed in Year 4 or Year 5 (only a few potential stock-outs that were always remedied), illustrating the impact of CMEP stock management interventions.

*Potential or Actual Stock Out*



**Figure 11: Potential or Actual Stock-Outs of ACT and RDT, Project Years 1 to 5**

These successes were achieved through collaboration with counterparts at all levels, especially in constant monitoring and web-based tracking of HF-level stocks, supportive supervision visits in HFs, and clear, frequent communication among health system and supply chain stakeholders at the HF, OD, PHD, and central levels.

## F. Lessons Learned and Best Practices to be Scaled Up for Malaria Control

### *Responding to Local Outbreaks in Pursat Province*

The increased malaria cases observed in PKV and KRK ODs at the beginning of CMEP implementation offered the opportunity to roll out a number of response interventions from which many lessons were learned. Response activities included (1) public announcements on malaria prevention, (2) LLIN assessment and top-up, (3) health education through IPC and the distribution of SBCC materials, and (4) mass screening, testing, and treatment of individuals in villages. From this, CMEP learned that cases were likely imported from forests, indicating a shift in focus to reaching forest workers and MMPs who may be harder to reach with HF and VMW services. Therefore, forest interventions were initiated in PKV and KRK ODs in Pursat Province.

### *Implementing and Scaling Up MMW Interventions*

The first cohort of 18 MMWs worked to conduct active case detection at annex villages close to or in forested areas, work sites in forests, and touchpoints near forests identified through case management activities at the HF and VMW levels. These activities yielded test positivity of 29% in work sites and 27% in annex villages, suggesting that these targeted and focused interventions identified a group in high need of malaria services. Among cases identified in Year 1, 72% were *Pf*/mixed, suggesting ongoing malaria transmission and the need for continued intervention. These lessons guided subsequent implementation in Years 2-5, in which MMW interventions and MMP-specific interventions were scaled up to meet the needs of the communities at the highest risk for malaria. In addition, CMEP supported the implementation of CNM IP-1 and IP-2 through training and

supervision as well as equipment and additional MMWs (cumulatively 43, including the existing ones) who continued to provide testing and treatment services, IPC, and SBCC materials to those at the highest risk for malaria. The effort successfully shifted Pursat Province from first to last among the seven provinces in terms of their numbers of malaria cases. Pursat was the province with the most malaria cases in 2018 and was the province with the least cases in 2020 and 2021.

## 4. Objective 3: Strengthen national malaria surveillance systems and M&E appropriate for malaria elimination and control activities

CMEP successfully strengthened national malaria surveillance systems and monitoring and evaluation structures for malaria control and elimination activities in Cambodia during the life of the Project. CMEP staff built the capacity of VMW/MMW, HF, OD, and PHD staff to support on-time reporting, recording, case notification, and data integration into the national malaria surveillance system (i.e., the malaria information system, or MIS). Additionally, CMEP built PP capacity in submitting referral slips to HFs according to guidance from the national program. Along with malaria case investigation and response, vector surveillance in terms of foci investigation and response was initiated and implemented by CMEP and was adapted by WHO and the national program.

### Objective 3 Achievements

% of elimination OD data on case notification, investigation, and responses linked to the Malaria Information System: 100% (Target = 100%)

% of HFs, VMWs/MMWs, and PPs in target ODs submitting surveillance data on time according to national guidelines: 92% (VMWs) and 79% (HFs; target = 90%)

Number of functional systems to detect and respond to all malaria outbreaks are at all ODs: 9 (of 9 ODs)

### A. Trainings

#### *Surveillance Technical Working Group*

CMEP supported surveillance technical working groups in Year 1 of implementation to elaborate on the surveillance manual for malaria elimination, translate the manual into Khmer, and print and distribute it. The MOH and CNM endorsed the manual on August 31, 2017. CMEP also supported the development of “Entomology Surveillance for Malaria Elimination in Cambodia,” which was endorsed by the MOH on December 25, 2018. Copies were printed and distributed in both English and Khmer.

#### *Reporting and M&E Trainings*

CMEP has supported a number of technical trainings in data reporting and M&E throughout Project implementation. These trainings focused on topics including M&E reporting forms, malaria surveillance in elimination areas, and mobile applications. In Year 1, it was determined that providers in SPL OD had been targeted for training on the case investigation not long before CMEP implementation began, using the previous case investigation form format for said training. Instead, CMEP worked to provide trainings on the new case investigation form formatted in 2017, aiming to cover 100% of relevant HF staff by integrating refresher trainings into monthly meetings for HF staff and VMWs.

#### **M&E Reporting Forms**

Monthly M&E reporting forms are essential for program monitoring and evaluation, high-quality decision making, and swift adaptation based on emerging programmatic data. The CMEP team provided M&E reporting form training throughout the life of the Project to improve capacity in reporting, increase data accuracy, and improve data availability for decision making. These trainings were of relevance to CNM, partners, VMWs, HF staff, and PPs who would either work directly with monthly registration reports or supervision checklists. Specific

training focus areas included the basic concepts of M&E, the use of the MIS and/or a health management information system (HMIS) in Cambodia, data collection, data management, data analysis, and data reporting. Over the life of the Project, CMEP conducted 11 M&E reporting form sessions, reaching 395 staff. Due to the COVID-19 pandemic, no M&E trainings were held in Year 5, despite a scheduled refresher training for HF and other staff. All staff meant to attend this refresher training had already been trained twice on M&E and thus still benefited from capacity building through CMEP during the life of Project.

CNM also conducted specialized M&E training for CMEP staff to provide on-the-job technical assistance to HF/OD/PHD supervisors to conduct monitoring of VMWs, to train CMEP staff on the installation of the relevant mobile applications to PCs and mobile devices, and to train CMEP staff on using the mobile application and analyzing data for future dissemination to field teams. This specialized training began in Year 3. During Year 4 and Year 5, the VMW monitoring forms were developed into e-checklists and successfully installed on the computer tablets of HF/OD staff for routine supervision/monitoring.

### **Malaria Surveillance and Mobile Applications in Elimination Areas**

Initial training on malaria surveillance and the use of mobile applications for collecting data began in Year 2. CMEP conducted three-day sessions to orient staff to using mobile applications and the importance of malaria surveillance in an elimination context. These trainings were targeted toward PHD, OD, and HC staff and were held in TMK and SPL ODs (a combined session), BTB OD, and MRS OD. These three sessions reached **163 staff in four ODs**. As additional ODs reached elimination or pre-elimination status in Year 4 (BKN, SPM, KRK, and PKV ODs), additional sessions were held. Finally, refresher trainings were held to maintain skills among staff and provide updates in line with current best practices.

#### *Routine Data Quality Assurance*

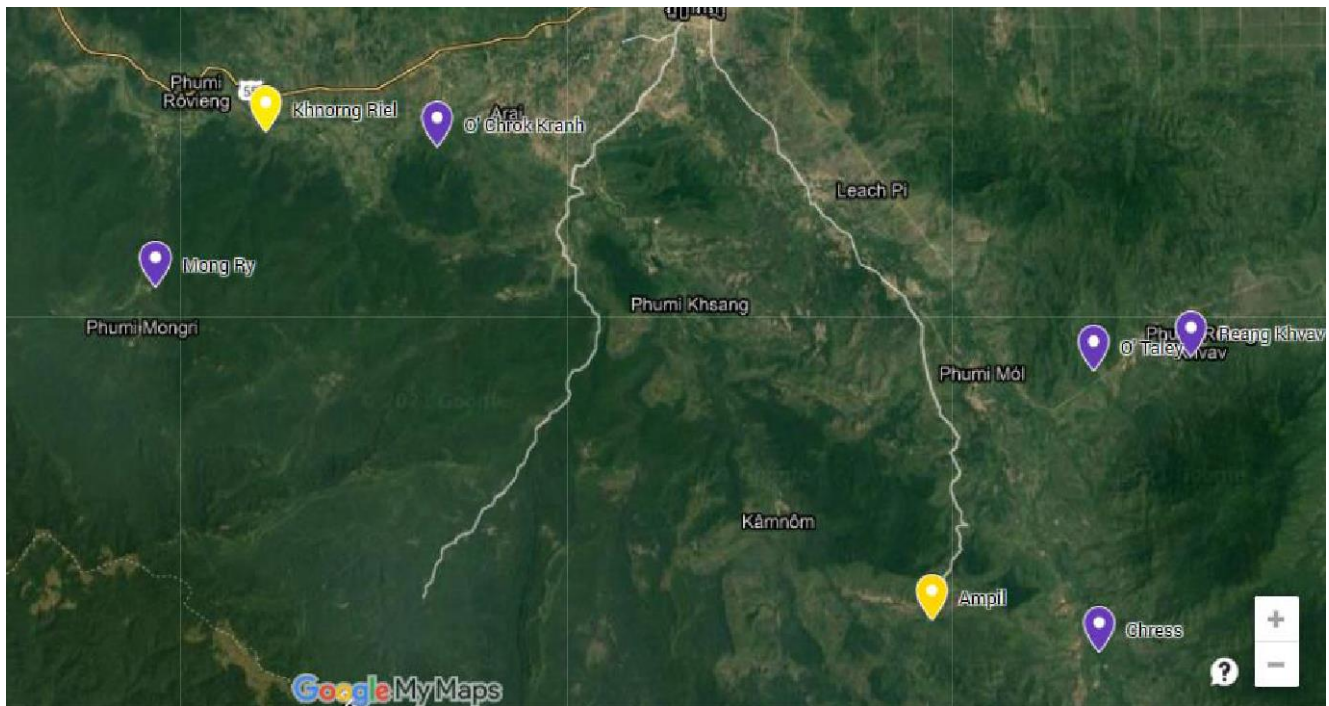
Routine Data Quality Assurance is an essential component of high-quality program implementation, and CMEP supported these efforts through trainings throughout the life of the Project. Trainings were conducted as standalone events and as an integrated component of monthly and bimonthly meetings to instill good practices in routine program implementation. CMEP hosted a Routine Data Quality Assurance training for 26 participants from the six CMEP ODs in Year 1, including two PHD HMIS staff, six OD directors, six ODMs, six OD HMIS officers, and six CMEP OD team leaders in Pursat.

#### *Entomologic Monitoring and Surveillance*

Since Year 1, CMEP has developed and improved web-based, interactive maps that update weekly to visualize malaria trends in CMEP target areas. CMEP has also provided capacity building for the conduct of entomological monitoring. In Year 1, CMEP, in collaboration with CDC advisors, developed a malaria entomology strategy, SOPs, and a training curriculum for CNM, PHD, and OD staff in a participatory process involving CNM representatives and other partners. The “Entomological Surveillance for Malaria Elimination in Cambodia” was signed by MOH and printed in December 2018. This strategy is the PMI-CMEP legacy supporting CNM to develop entomological monitoring and surveillance, and it is applied countrywide to this day.

CMEP subsequently supported entomologic monitoring through training activities targeted toward the CNM entomology unit in Year 2. Via these activities, 26 PHD staff from PHDs and ODs were oriented on the basics of the malaria lifecycle in humans and mosquitos, the epidemiology of malaria in Cambodia, and strategies for malaria control. CMEP additionally conducted trainings targeted toward HF staff and VMWs in PKV and BTB ODs, who subsequently acted as entomological field technicians.

During Years 4 and 5, when foci investigation was conducted, CMEP tracked all foci to highlight locations where malaria active transmission is occurring. Figure 12 showcases foci in PKV OD of Pursat Province in 2020 and 2021. All foci have been monitored, and follow-up has occurred every 12 months in order to reclassify those foci from active to residual and to clear foci based on updated malaria cases detected in the past 12 months.



**Figure 12: Example of a Web-Based, Interactive Map Produced by CMEP to Visualize Malaria Foci**

In Year 3, CMEP, with technical assistance from the CNM entomology unit, conducted eight monthly sentinel entomological collections. The sentinel sites for the work were in Mol Chas Village in PKV OD (Pursat Province). The sites were in proximity to the village (Mol Chas is an “annex” type village with proximity to the forest and is situated along the main access points to the forest). Three collection methods (two cattle-baited traps, five light traps, and two human landing collections) were used over a five-day period as part of each monthly visit. All collected *Anopheles* mosquitoes were morphologically identified by CNM entomology technicians under the supervision of the CNM entomologist and CMEP staff in Phnom Penh. PHD and OD staff also actively participated in the collection activities.

During the eight collections, 11,744 *Anopheles* mosquitoes were collected, comprising 32 species as per the morphological identification. Of these, 7,871 (67%) were collected during July, August, and September 2019, which clearly shows the normal rainy season’s contribution to the mosquito population.

Out of the total collection, there were six *An. dirus* (primary vector), 14 *An. minimus*, and 99 *An. maculatus* (both secondary vectors). In addition to these, all potential vectors shown in previous studies were also present in considerable numbers. These mosquitoes were properly preserved and brought to CNM for further analysis and kept at the CMEP office under recommended analysis conditions. This activity was completed in Year 3 and was not a continuous activity.

#### *OD-Level Support*

CMEP provided OD-level training support, primarily in Years 1 and 2, focusing mainly on the capacity of OD teams to respond to malaria outbreaks as recommended by national strategies. To assess required support, the CMEP team considered the following criteria: (1) ODMS having been trained in the last two years on malaria surveillance and outbreak detection; (2) having an available rapid response team at an OD; (3) team members having been trained on malaria outbreak response in the last two years; and (4) having available materials for outbreak response (RDTs, ACT, ITNs, BCC materials). CMEP conducted this assessment in SPL and BTB ODs and found that most criteria were met, although it was noted that the role of CMEP in outbreak response preparedness should be largely transferred to CNM and local actors to ensure a sustainable improvement in outbreak response. In Year 2, CMEP provided a two-day training on malaria outbreak detection and response to 33 PHD and OD staff to improve sustainability and local capacity building. Later, outbreak response topics were incorporated into the surveillance training agenda.

## B. LLIN Durability

CMEP conducted LLIN durability monitoring throughout the life of the Project, including a baseline assessment in July 2018, a Round 2 follow-up in February 2019, Round 3 follow-up in June 2020 (delayed from March 2020 due to the COVID-19 pandemic, which limited the ability to conduct at-home and in-person follow-up visits), and the Final Round follow-up in August 2021 (fieldwork was completed in June 2021 due to the COVID-19 pandemic, which limited the ability to conduct at-home and in-person follow up visits). The study took place in BTB and KRK ODs, in which the initial baseline data collection was conducted about three months after the CNM LLIN mass distribution campaign in 2018. The baseline survey was implemented using paper questionnaires and was subsequently migrated to a digital data collection system to improve data quality and efficiency. Questions remained the same among all four visits, and most respondents remained available for follow-up visits (although some residents had moved and could not be reached). The purpose of the LLIN durability monitoring study is to provide data and insights into the decline of LLIN conditions through normal usage and to provide further data on the frequency of LLIN top-up and replacement in Cambodia.

LLIN coverage has decreased over time in both ODs, from 90.7% at baseline to 51.9% in the final round in BTB and 81% to 63.6% in KRK. Similarly, overall attrition was 31.9% in BTB and 47.3% in KRK in the final round of follow-up. These results meet expectations of decreased survivorship over time and increased attrition over time, given that normal wear and tear is expected with continued LLIN use. As of the Final Round report, 65.6% of LLINs were rated as “good serviceability,” 24.6% as “serviceable,” and 9.8% as “too torn” in BTB. And 64.3% of LLINs were rated as “good serviceability,” 26.2% as “serviceable,” and 9.5% as “too torn” in KRK. A full description of the study, detailed results, and conclusions are presented in the “CMEP LLIN Durability ‘Final Round’ Report.”

## 5. Objective 4: Build the capacity of the malaria program to manage, intensify, and sustain malaria control and elimination efforts, particularly at the OD level

CMEP contributed significantly to malaria policy and guidance development in Cambodia, setting the stage for the “Malaria Elimination Action Framework 2021-2025” (MEAF 2) and codifying important progress toward malaria elimination into national policy. In addition to this high-level support, CMEP provided planning support at the OD level, supporting the development and implementation of AOPs to include malaria activities and funding. These efforts have contributed to evolving guidance on the path to malaria elimination and have helped institutionalize the gains won by CMEP in eliminating malaria in Cambodia.

### Objective 4 Achievements

% of AOPs in all target ODs, including all malaria activities and budgeted activities developed: 100% (Target = 100%)

% of planned supervisory visits conducted by HFs and VMWs/MMWs for all targeted ODs: 83% (Target = 90%)

% of planned supervisory visits conducted by PHDs and CNM staff for all targeted ODs: 89% (Target = 90%)

NTGs and national surveillance guidelines for malaria are regularly updated and disseminated (CMEP provides regular technical assistance to CNM and



## A. CMEP's Contribution to Developing Malaria Policies and Guidelines

### *Capacity-Building Activities*

CMEP supported two major capacity-building activities related to managing, intensifying, and sustaining malaria control and elimination efforts: program management, case diagnosis with quality malaria microscopy services, case management and follow-up, technical supervision and monitoring, and on-the-job training/coaching. The Project supported these elements throughout the life of the Project, offering training courses and capacity building. CMEP supported three-day training courses on program management for 45 staff, including PHD and OD staff from CMEP provinces and ODs.

Additionally, CMEP supported a training course on national or internal competency assessments conducted by the CNM lab unit, holding initial trainings and refresher courses over the life of the Project, starting in Year 1. These trainings were directed toward microscopists at referral hospitals, former district hospitals, and HCs with the goal of building microscopists' capacity to increase the number of experts in malaria diagnosis. CMEP supported the training of **66** microscopists in supported ODs through this initiative, which includes refresher trainings, periodic supervision to ensure functional lab equipment, slide cross-checks, and on-the-job training.

### *AOP Development and Monitoring*

CMEP supported the development and implementation of AOPs throughout the life of the Project. This support was provided primarily through AOP development and endorsement, then progress review sessions at the OD level, review meetings highlighting CMEP implementation priorities, and supportive supervision visits led by CNM central, provincial, and district units to HFs, VMWs/MMWs, and PPs. Over the life of the Project, CMEP supported **66** progress review sessions and **455** supervision visits. The following subsections describe some key findings and lessons learned from the supervision visits:

*CMEP supported*

**66**

*AOP progress review sessions and*

**455**

*AOP supportive supervision visits over the life of the Project*

#### **Weaknesses Identified**

- Discrepancies between recorded and reported data in some HFs
- Limited use of the MIS for data entry, analysis, and use
- Poor quality of malaria education among PPs and some VMWs; less commitment from PPs
- Lack of malaria education materials at HCs
- RDT use for diagnosis at referral hospitals, which have microscopy capabilities

#### **Mitigating Actions and Positive Observations**

- Uninterrupted services provided by HFs, VMWs, and MMWs
- Regularly scheduled meetings, monitoring, and supervision
- Rapid identification and response to weaknesses for improved reports and data use

As Project implementation continued, additional positive observations were noted, especially in case detection and treatment follow-up among HFs, VMWs, and MMWs; rapid identification of cases; and responses conducted.

Aside from the routine supervision visits, CMEP central and OD teams facilitated the visit of Professor Mam Bun Heng, the health minister of Pursat Province, to Phnom Kravanh District at the triangle area of the three provinces of Pursat, Kampong Speu, and Kampong Chhnang. The delegation comprised 68 participants, including the health minister and MOH delegates, Pursat's provincial governor/deputy governor, the chair of the provincial council, members of the Provincial SWGME, the CNM director and subordinates, three PHD directors, the provincial malaria supervisor, ODMSs, the CMEP team, USAID/PMI, and other partners. The health minister was

accompanied by the Pursat provincial governor to the PKV HC and referral hospital, then continued the visit to the forest location. The visit's purpose was to physically witness and talk to the forest goers and see the Project approach to address increased malaria cases in the forest areas. This was the first visit of the health minister to any partner location, and it highlights the interest in CMEP's interventions in Cambodia.

### *e-Payments for VMWs*

CMEP worked to introduce e-payments for VMWs to improve the transparency of cash transfers and to ensure consistent and traceable payment protocols. After a mapping exercise to understand the available electronic payment services in Year 1, CMEP selected a service provider and introduced e-payments to VMWs in SPL, PLN, BTB, and MRS. From Year 2, this e-payment was smoothly applied in all CMEP ODs where VMWs were available.

### *Policy Documents and Guidelines*

Throughout the life of the Project, CMEP has contributed to policy documents, guidelines, and other technical resources to sustainably improve the quality of malaria service delivery in Cambodia, to build the capacity of CNM in malaria control and elimination, and to foster local ownership of interventions. These contributions include joining and participating in meetings convened by CNM and WHO; initiating and sharing CMEP approaches and successes with CNM and implementing partners; and jointly developing, translating, printing, and distributing official documents. The overall contribution of CMEP to malaria policies and guidelines in Cambodia was substantial and included the following documents:

#### **Year 1**

- **National Case Management Guidelines** on the management of uncomplicated malaria cases and RDT use
- **Malaria Surveillance Manual**
- **Mobile and Migrant Population Strategy**

#### **Year 2**

- Updating the **Entomological Surveillance Manual for Malaria Elimination** (review/edit, translate into Khmer, and plan for support in printing books by CMEP)
- **Dissemination and Training**
  - Training on the **Malaria Surveillance Manual** for all target ODs for malaria elimination for Kampong Chhnang, Kampong Thom, Siem Reap, and Pailin Provinces.
  - With the WHO team, CMEP supported a workshop on **Dissemination of Malaria National Treatment Guidelines** to all national hospitals in Phnom Penh.
  - CMEP supported the dissemination of the **Migrants and Mobile Populations Manual** to PHD and OD teams in Siem Reap.

#### **Year 3**

- CMEP supported CNM and WHO in conducting field testing on the foci investigation process, which informed the development of the **foci investigation protocol, SOPs, tools, and all related procedures and processes** to conduct foci investigation and management.
- The long-awaited *Pv* radical treatment and roll-out of G6PD testing — along with the 14-day PQ administration and rigorous case monitoring/follow-up — was a significant breakthrough decision that was facilitated by CMEP along with CNM, CHAI, and WHO. The CMEP technical team played a very important and critical role in **developing the relevant tools (SOPs, treatment regimen, job-aids, training guidance, HF case register, etc.)**.
- **Dissemination and Training**
  - CMEP, along with the Pursat PHD, organized the MMW training for 32 forest rangers in Pursat Province with notable results, along with a set of equipment, materials, RDTs, ASMQ, PQ, LLIHNS, and recording tools. These forest rangers came from the three administrative districts of Krakor, Phnom Kravanh, and Veal Veng, Pursat Province.

## Year 4

- The success of *Pv* radical treatment in Battambang and Pailin Provinces contributed to the CNM decision to plan for countrywide scaling of *Pv* radical treatment in late 2020/early 2021. The CMEP team, along with CNM, CHAI, and WHO, played a very important and critical role in developing and **updating the relevant tools (SOPs, treatment regimen, job-aids, training guidance)**.
- The CMEP additional application of *Pv* investigation/classification has been positively received and is being considered as a tentative agenda for the National Surveillance Working Group to **revise the surveillance manual and tools to include full *Pv* investigation, classification, and response**. A remarkable success in CMEP Year 5 is the inclusion of *Pv* malaria cases in the updated national surveillance manual, along with training that was provided to all field implementers. This success ensures that every person with a case of malaria of any *Plasmodium* species receives a timely notification and is classified within one day, receives a response within three days, and for case classification *Pf* L1, has a foci investigation conducted within seven days.
- **Dissemination and Training**
  - CMEP received MEAF 2 from CNM and facilitated its dissemination to counterparts at OD and PHD levels as well as to CMEP central and field teams.

## Year 5

- The success of the incorporation of *Pv* malaria into comprehensive surveillance is a great addition to the efforts being made for *Pf* malaria to similarly ensure every *Pv* case includes a notification in a timely manner, investigation/classification, and a response (along with *Pv* radical treatment and follow-up). CMEP has actively joined in **updating and finalizing the surveillance manual, conducting train-the-trainer training and cascade training of malaria elimination surveillance, and is currently monitoring implementation at the ground level**.

# 6. Challenges and Mitigating Actions

## Reaching the Most At-Risk for Malaria

The epidemiology of malaria in Cambodia is complex and varies greatly based on geography and human migration patterns. The people at the highest risk for malaria in Cambodia tend to be migrant and mobile populations who work in forested areas. These areas are often hard to access, far from HCs, and not covered by cellular networks. To mitigate these challenges, CMEP capacitated MMWs, who work specifically in forested areas to better access these at-risk communities. Similar to VMWs, MMWs perform RDTs in the community and can provide ACT upon a positive test result. These data are collected biweekly/monthly, and all were entered into the MIS.

## Real-Time Data for Decision Making

As malaria becomes an increasingly rare disease in Cambodia, the importance of real-time data for decision making increases dramatically. Malaria hotspots in forested areas are often poorly connected to the Internet, indicating a need for a lightweight and flexible case-reporting solution. CMEP initially used SMS reporting to facilitate case reporting within 24 hours and to ensure rapid response to malaria cases.

## *Pv* Radical Treatment with G6PD Levels

Over 30% of *Pv* cases ( $\approx 20\%$  having G6PD between 4 and 6 U/gHb and  $> 10\%$  having deficient G6PD) are not yet covered for 14-day PQ treatment. These patients continue to have relapse episodes and pose a high risk for new transmissions.

## LC Classification of *Pf* Cases

CMEP has been committed to conducting foci investigation for all *Pf* cases in its target areas, regardless of whether they are classified cases. But most suspicious foci were found to be inside deep forest and very hard to reach — even inaccessible — or required walking to the location for several days. These factors made it challenging to potentially identify new local cases.

## COVID-19

Restrictions on in-person gatherings of people made it challenging to carry out meetings, trainings, or workshops. It taught us how to live with new ways in respect to the COVID prevention protocol and also try our best with virtual meetings or trainings. During Year 4 and Year 5, several CMEP activities were postponed/delayed and some were completely missed, for instance, the PSWGME/DSWGME meetings were not conducted in Battambang and Pailin in 2021. Nevertheless, some meetings were still manageable by shifting from group meeting to individual visit, such as each VMW/MMW came separately to HF for monthly report submission and supplies ‘replenishment. And some meetings were virtually organized, such as CMEP central progress review meeting, etc. CMEP team also participated in meetings organized by CNM and other stakeholders. Everyone has to live and work under COVID presence as one of public health issues by adapting with new ways of communication.

# 7. Lessons Learned and Success Stories

## Lessons Learned

*Proven technical solutions should be implemented collaboratively with local partners.*

CMEP has pioneered a number of important technical solutions on the path to malaria elimination, including the 1-3-7 approach, radical cure of *Pv* using SLDPQ, and qualitative G6PD deficiency testing. These approaches should continue to be implemented in partnership with local staff at the PHD, OD, and VMW levels, as relevant, ensuring a locally led, adaptive response. Similarly, the specific package of interventions should be finely tailored at the local level based on epidemiologic risk, underscoring the need for real-time or near-real-time data for decision making at every level of program implementation.

*Capacity building should empower CNM, PHD, OD, and VMW staff to protect gains in the path toward malaria elimination in Cambodia.*

CMEP has successfully and sustainably built local capacity among PHD-, OD-, and VMW-level staff, improving data quality, clinical practice, and understanding concerning malaria interventions in Cambodia. The extent to which PHD and OD-level staff are involved in the planning, coordination, and implementation of malaria elimination activities should be increased, placing an emphasis on local leadership and locally driven implementation. The continuation and enhancement of existing working groups, including provincial and district-level SWGMEs, are necessary to foster collaboration.

## Success Stories

Success stories are presented in Annex 4.

# INTEGRATION OF CROSSCUTTING ISSUES

## Inclusive Development, Gender Equality, and Female Empowerment

Throughout the life of the Project, CMEP placed emphasis on the participation and representation of women in malaria programming, including during the ongoing challenges of the COVID-19 pandemic. CMEP annual team meetings included gender sensitization workshop sessions for CMEP in-house staff. During all CSO quarterly meetings, CMEP staff conducted sessions to strengthen the capacity of staff members from the two CSOs (AHEAD and PFDA) on various topics, with the one on gender equality given careful attention. The material covered in the sessions enabled the CSO staff to better understand the differences between sex and gender, sexual orientation, power dynamics, and equity and equality issues. These sessions helped the two CSO partners become more familiar with gender issues in the Cambodian context. The CSO staff were then able to mainstream gender issues in the malaria situation in Cambodia and understand the importance of always seeking disaggregated datasets for girls and boys and for women and men to be able to make evidence-based decisions on gender.

The two CSOs subsequently integrated gender equality concepts into all their planning and implementation work by making flexible schedules to organize health education campaigns that were cognizant of the available and preferred times of target populations. The emerging COVID-19 situation in Quarter 2 of FY2021 created some challenges; however, the CSOs were able to get good participation from more vulnerable groups. (It was observed that there was more participation from girls and women during this time in the sessions.) Overall, the focus of the two CSOs' activities was targeting male MMPs in the remote and/or hotspot areas, who were identified as the main high-risk group that could benefit most from project implementation. Importantly, all the reported data generated through CSO implementation was disaggregated per male and female. This disaggregation enabled CMEP and the CSOs to clearly understand the level of male/female participation in activities and understand how each group benefits.

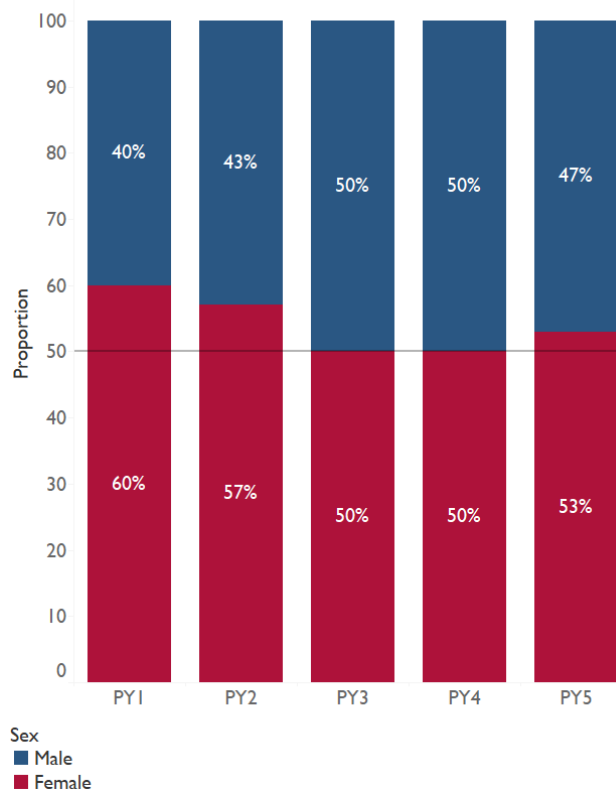
With case distribution in Year 5, 100% of service coverage was observed for both males and females. For health facility service provision, the overall split for female and male patients was **8%** and **92%**, respectively). As shown in Figure 13, the distribution of male vs. female VMWs has remained nearly at parity, ensuring that females can seek treatment/services from a female provider. Importantly, women have an essential role in the household and community levels in providing malaria education, promoting the use of ITNs, and encouraging persons to seek out available health services.

Among CMEP staff, the female-to-male ratio at the end of Year 5 was **19/59**.

## Sustainability Mechanisms

CMEP worked with sustainability in mind throughout Project implementation, focusing on building relationships with Royal Government of Cambodia partners, building the capacity of PHD and OD staff, and working with

Sex Distribution of VMWs



CNM to strategize for malaria elimination in Cambodia. As shown in this report’s earlier section about Objective 4, CMEP conducted consistent capacity-building activities with CNM, including capacity building among OD and PHD staff. AOP development activities served to build the capacity of local staff in planning for malaria programming and its eventual elimination, ensuring a locally owned approach.

## Environmental Compliance: Environmental Mitigation and Monitoring

In line with the Environmental Mitigation and Monitoring Plan (EMMP) endorsed by the Mission on June 12, 2017, CMEP continued to implement a set of activities to prevent and mitigate any possible environmental impact associated with Project activities. Progress against key EMMP indicators is presented in the following subsections.

### Objective 1 – Task 2 and Objective 2 – Task 2: Ensure LLIN coverage and usage (net distribution and impregnation), including related ITN activities, by CBO/CSO

#### *# of Households/Farms Collecting and Storing Old Nets Properly*

The results of the ITN monitoring activity conducted by VMWs and MMWs over the life of the Project found a total of **71,119** damaged/torn ITNs (Table 4), suggesting that each household may have had at least one damaged or torn net available at home during the visit. HC teams taught households how to store old nets properly during their monitoring visits throughout the Project.

**Table 4: EMMP: Results from ITN Monitoring — Collecting and Storing Old Nets Properly**

Disaggregation	PY1	PY2	PY3	PY4	PY5	Grand Total
Farms			1,531	162	147	<b>1,840</b>
Households	7,275	9,565	24,441	18,426	9,572	<b>69,279</b>
<b>Grand Total</b>	<b>7,275</b>	<b>9,565</b>	<b>25,972</b>	<b>18,588</b>	<b>9,719</b>	<b>71,119</b>

*Note:* PY means Project Year (i.e., a given year of CMEP).

#### *# of VMW/MMW with Proper Net Management*

During supervision, a small net usage survey conducted by OD teams found that 94% of VMWs had carried out proper net management over the life of the Project, and over 95% had practiced proper net management since Year 3 (Table 5).

**Table 5. EMMP: VMWs/MMWs with Proper New Management**

PY1	PY2	PY3	PY4	PY5	Grand Total
85%	88%	98%	100%	100%	<b>94.2%</b>

#### *# of Net Impregnation Sites Observed with Proper Pesticide Management*

CMEP has not done any net impregnation. Similarly, other partners, including CNM, are not planning to do it.

## Objective 1 – Task 6 and Objective 2 – Task 5: Procure reagents, supplies, and equipment for malaria microscopy and RDTs at provincial and district levels

### *# of HF Staff/VMWs/MMWs/PPs Trained on Safe Use and Disposal*

A total of 831 staff were trained in the safe use and disposal of reagents, supplies, and equipment over the life of the Project. Additionally, monthly and bimonthly/quarterly meetings presented key messages on waste disposal and needle disposal. A total of 3,257 safety boxes were distributed over the life of the Project (Table 6).

**Table 6: EMMP: Staff Trained on the Safe Use and Disposal of Reagents, Supplies, and Equipment**

Disaggregation	PY1	PY2	PY3	PY4	PY5	Grand Total
Safety Boxes		633	1,952	672	0	<b>3,257</b>
Training	831					<b>831</b>

### *# of HFs following approved storage and disposal guidance*

*Management of used RDTs:* All HFs followed the approved storage and disposal guidance for used RDTs (Table 7). Used RDTs were collected and stored properly on a daily basis for incineration at sites.

**Table 7: EMMP: Proportion of HFs Following Approved Storage and Disposal Guidance**

Disaggregation	PY1	PY2	PY3	PY4	PY5	Grand Total
Used RDT	100%	100%	100%	100%	100%	100%
Grand Total	100%	100%	100%	100%	100%	100%

*Management of expired RDTs:* When supportive supervision visits were carried out, all available RDTs at each health facility had not yet expired. Over the life of the Project, discussions were held to ensure the replacement of any soon-to-be expired RDTs.

*Management of expired antimalarial drugs:* No health facilities reported having expired antimalarial drugs, and in cases where antimalarials were close to expiration, appropriate measures were taken to dispose of drugs in accordance with CNM protocols.

## Objective 1 – Task 3 and Objective 2 – Task 3: Handling and Usage of RDT Kits and Slides by HFs and Community Workers

### *# of Used RDTs Collected from VMWs/MMWs/PPs Monthly*

There were **337,319** RDTs collected from VMWs/MMWs (during monthly VMW/MMW meetings; Table 8). They were properly stored for further incineration at HFs over the life of the Project.

**Table 8: EMMP: Used RDTs Collected from VMWs/MMWs/PPs**

Disaggregation	PY1	PY2	PY3	PY4	PY5	Grand Total
Used RDT	15,379	24,728	67,624	150,536	79,052	337,319
Grand Total	15,379	24,728	67,624	150,536	79,052	337,319

*# of HFs following approved storage and disposal guidance*

*Management of used RDTs:* All HFs followed the approved storage and disposal guidance for used RDTs (Table 9). Used RDTs were collected, stored properly, and incinerated at sites daily/weekly.

**Table 9: EMMP: Proportion of HFs Following Approved Storage and Disposal Guidance**

Disaggregation	PY1	PY2	PY3	PY4	PY5	Grand Total
Used RDT	100%	100%	100%	100%	100%	100%
Grand Total	100%	100%	100%	100%	100%	100%

## Science, Technology, and Innovation

- CMEP supported the national program, rolling out modern technologies (mobile applications) for real-time reporting. As a result, HF staff and VMWs/MMWs have been equipped with and trained on electronic reporting devices. And they are applying their knowledge, apps, and devices in their reporting activities.
- The CMEP innovation of the 1-3-7 elimination model proved successful in elimination surveillance and drastically reduced malaria cases in CMEP areas. The model has now been replicated in other areas of Cambodia.
- The establishment of a telegram network and virtual communications facilitated program interventions, allowing them to operate smoothly.

## Transparency and Accountability

- CMEP followed and respected the Cambodian government’s laws and regulations (e.g., public holidays, National Social Safety Fund).
- CMEP jointly developed a work plan and OD AOP and implemented and monitored the planned activities with a lead from government counterparts.

## Private Sector Engagement

- CMEP followed the MOH Prakas issued in April 2018 to restrict PPs from malaria testing and treatment.
- Through the provincial/district SWGMEs, the private sectors have been engaged to participate in and support malaria elimination. For example, farm/company owners shared a list of their MMWs for ITN distribution, malaria screening, and the organization of health education events.



## COORDINATION AND PARTNERSHIP

During the five-year lifetime of CMEP, collaboration and coordination with government and partners were central to the whole Project approach. CMEP always worked closely with CNM and partners to ensure that all activities were strategically aligned and integrated with national strategies, priorities, and programs. The MEAF 2 (2021-2025) implementation began in Year 5 of CMEP (January 2021), and consequently, CMEP’s implementation in Year 5 incorporated elements of MEAF 2. To ensure that CMEP achieved its goals, it implemented activities with CNM teams on the ground. This approach continued to help implementation, sustainability, and capacity building. CMEP and CNM collaboration also included regular joint supervision visits at the ODs, AOP development, central review meetings, support for Provincial/District Malaria Special Working Group meetings, and support for the CNM malaria conference and World Malaria Day (WMD).

Coordination initiated by CMEP and CNM led to a joint visit and meeting among the three provinces in the triangle area with common borders (Pursat, Kampong Chhnang, and Kampong Speu). Participants discussed and exchanged strategic information and interventions and collaboratively planned to respond to the malaria situation in the areas sharing borders.

Although COVID-19 severely impacted CMEP’s ability to carry out large gatherings from Year 4 onward, the Project successfully supported key events and meetings with CNM in online formats (including the CNM malaria conference and central review meetings). Also, CMEP always participated in national technical working groups as required and maintained ongoing communication with CNM to discuss any increases in malaria cases and to agree upon any required response plans.

Throughout the project, CMEP collaborated with key malaria partners in Cambodia, including WHO, the Global Fund, United Nations Office for Project Services (UNOPS), and other malaria actors present in Cambodia (see Table 10 for details).

**Table 10: CMEP Partners and Areas for Collaboration**

Partners	Areas for collaboration
Global Health Supply Chain Program – Procurement and Supply Management (GHSC-PSM; PMI-funded)	Collaboration focused on the procurement of commodities as a buffer for filling any gaps identified in the CMEP target areas (including LLINs, LLIHNs, and RDTs).
Global Fund for Fighting AIDS, Tuberculosis, and Malaria (Global Fund)	Collaboration included receiving a supply of commodities, including LLINs, LLIHNs, RDTs, and ACT. Importantly, CMEP participated in all Global Fund and “principal recipient” meetings to brief on CMEP elimination work and also provided technical advice and guidance so as to develop uniform and standardized operational plans for malaria work (including scaling up <i>Pv</i> radical cure work).
Population Services International (PSI)	CMEP and PSI worked together on SBCC, especially regarding work for the Promoting Health Behaviors (PHB) Project. CMEP’s malaria experience with developing forest goers’ BCC materials and work in Pursat Province helped PHB develop its own SBCC plans. CMEP also attended the National SBCC Working Group meetings and presented CMEP work.
World Health Organization (WHO)	Technical support was provided from WHO to CNM to guide strategy development. CMEP, along with WHO, participated in several meetings to revise, revisit, and develop SOPs, tools, materials, and training frameworks for all malaria elimination work. Discussion on revisiting the NTGs and the surveillance manual was a task where CMEP closely worked with WHO and CNM. In addition, CMEP continued to work on developing the treatment protocols on <i>Pv</i> radical cure, along with job aids, training materials, etc., which were to be scaled up for the entire country, involving significant training events where CMEP was one of the principal facilitators.

Partners	Areas for collaboration
Institut Pasteur of Cambodia	The Institut Pasteur of Cambodia and CMEP maintained communication along with CNM and other partners in different meetings. Recently, the Institut Pasteur, CNM, and UNOPS proposed plan to evaluate POC G6PD performance will target Pursat areas of CMEP.
Clinton Health Access Initiative (CHAI)	CMEP continued to work with CHAI regularly. CMEP staff are in close contact with CHAI staff in supporting CNM to organize nationwide trainings and workshops.
Action for Health And Development (AHEAD)	This CMEP sub-grantee assisted in expanding malaria services to hard-to-reach areas.
Partner for Development in Action (PFDA)	This CMEP sub-grantee assisted in expanding malaria services to hard-to-reach areas.
Health and Social Development (HSD)	Supported the model of <i>Pv</i> radical cure (HF-based G6PD testing/treatment) and VMW follow-up. Also, provided mobile Apps to facilitate <i>Pv</i> radical cure follow-up on PQ compliance and side effects.
Mahidol Oxward Tropical Medicine Research Unit (MORU)	Supported the Therapeutic Efficacy Study (TES); and <i>Pv</i> radical study with three arms of interventions.

## CONCLUSION AND RECOMMENDATIONS

The USAID CMEP made impressive and sustainable strides toward malaria elimination in Cambodia. Leveraging the successful 1-3-7 elimination model first implemented in SPL OD, the Project expanded implementation to improve case finding, treatment, notification, investigation, response, and follow-up activities at the OD, HF, and community levels. VMWs/MMWs, under supervision from HF, OD, and CMEP, improved scope and access to hard-to-reach migrant and mobile populations, extending the capacity of CNM programming to reach the people the most at risk for malaria in Cambodia. This ongoing partnership with CNM has led to a number of technical assistance opportunities, including participation in the development of the MEAF 2 and expansion of the 1-3-7 approach to ODs outside of the CMEP catchment area. Finally, CSO involvement in case finding and IPC activities has improved local capacity and ownership in malaria elimination efforts, ensuring a locally aware approach to malaria elimination. Specific aspects of the approach will ensure comprehensive and effective program management for the long run: active participation from health and non-health sectors and multi-sectoral collaboration at all levels — from the central level at MOH down to the operational level, especially at provincial and district levels under the leadership of provincial and district governors.

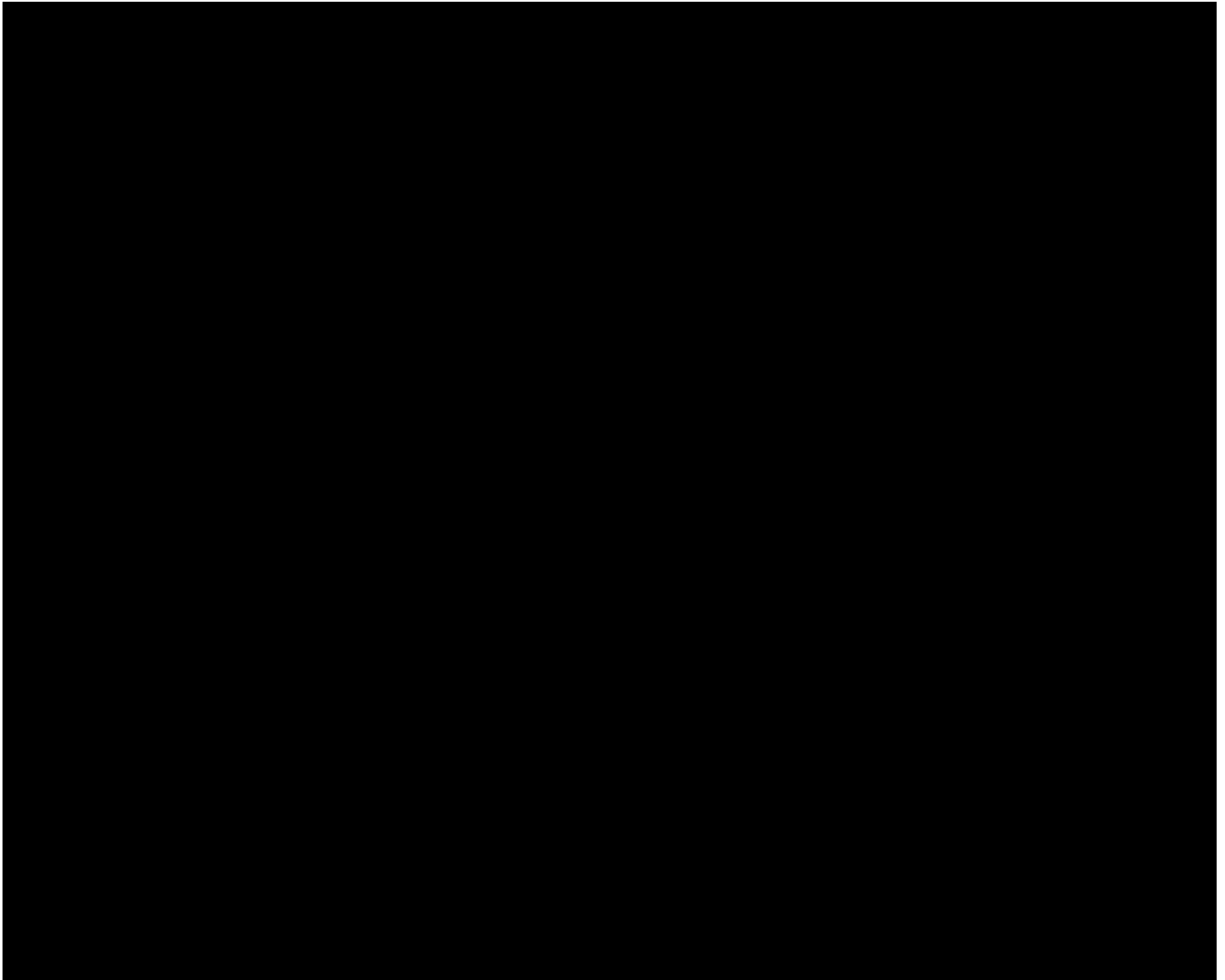
Malaria elimination in Cambodia is within reach. The continued implementation of the 1-3-7 model, development and scale-up of innovative and evidence-based elimination interventions, and collaboration with CNM, PHDs, ODs, and international partners like WHO will be essential in reaching the ultimate goal of malaria elimination. To operationalize these recommendations, future work should consider localized malaria risk for efficient delivery interventions like ITNs and IPC, should enhance the quality and availability of data for decision making at all implementation levels, and should encourage domestic resource mobilization for continued implementation of prevention, case management, and surveillance activities. Finally, preventing malaria reintroduction in areas where no malaria cases are reported will be an essential element to maintaining the gains won in CMEP and continuing toward malaria elimination.

# ANNEXES

## Annex 1. Publications and Knowledge Management Products

- Lessons learned from *Pf* elimination in Battambang and Pailin and case reduction in Pursat in 2020.
- CMEP video documentation about best practices and lessons learned has been shared publicly through USAID, URC, and CNM social media. Link to video on URC's YouTube channel:  
<https://www.youtube.com/watch?v=5CVaOmdooqw&t=3s>

## Annex 2. Comparison of Actual Expenditures with Budget Estimates



**Table A2-2: Actual Level of Effort by Position vs. Ordered**

Position	Approved LOE per Mod. 11	Actual LOE, Years 1-5	Variance
Key Personnel	3,959	3,966	-7
HQ Back Stopping	786	734	52
Cooperating Country Personnel	57,574	57,318	256
<b>Total Professional Workdays (LOE)</b>	<b>62,319</b>	<b>62,018</b>	<b>301</b>

Note: LOE is the abbreviation for the level of effort.

### Annex 3. Public Events and Press Coverage

- The Malaria Annual Conference was organized every year in February, including 2017, 2018, 2019, 2020, and 2021.
- WMD events: In-person forums were organized on April 25, 2017, April 25, 2018, and April 25, 2019. For April 25, 2020, and April 25, 2021, the WMD events were not held in person due to COVID-19 restrictions. However, there were banners produced and displayed in all HFs and at entry points to forests where MMWs were standing by. Also, a message from the prime minister was broadcast in CMEP provinces and countrywide.
- A visit and meeting were hosted in the triangle area among the three provinces with common borders (Pursat, Kampong Chhnang, and Kampong Speu) March 19-21, 2018. The CNM director, PHD directors, and other malaria stakeholders participated.
- The health minister traveled to Pursat Province on June 3 and 4, 2019, visiting the remote/forested area where most at-risk populations move/settle. The CNM director, provincial and district governors, and many donor and partner representatives accompanied the health minister on his visit.
- The U.S. Ambassador to Cambodia visited Pailin Province on October 19, 2020. The Pailin PHD director and team, the CMEP Chief of Party and team, and a CMEP sub-grantee’s executive director and team joined the ambassador’s visit to Krachab HC in Pailin.

### Annex 4. Success Stories and Beneficiaries’ Feedback

- Five success stories from all five CMEP annual progress reports (FY2017, FY2018, FY2019, FY2020, and FY2021).
- Lessons learned from *Pf* elimination in Battambang and Pailin and case reduction in Pursat in 2020.

### Annex 5. List of Sub-Partners and Grantees

- AHEAD worked in five ODs in Battambang and Pailin provinces.
- PFDA worked in four ODs in Pursat Province
- OEC worked in MRS OD (dropped early in CMEP Year 3)

### Annex 6. Activity Monitoring, Evaluation, and Learning Plan

- CMEP M&E Plan
- CMEP Performance Indicator Tracking Table (PITT)