



LAO PEOPLE'S DEMOCRATIC REPUBLIC
Peace Independence Democracy Unity Prosperity



Malaria NSP 2021-2025

Lao PDR

Center of Malariology, Parasitology and Entomology
Department of Communicable Diseases Control, MOH
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FOREWORD

The Lao PDR Ministry of Health is pleased to release the revised National Malaria Strategic Plan (2021-2025). The document is a roadmap that lays out the goals, objectives, strategies, parties responsible, coordination mechanisms, and costs to successfully reduce the burden of malaria in the Lao People's Democratic Republic (PDR) over the next five years and to prepare the country for national elimination by 2030. The 2021-2025 Strategy is the second part of a three-phase approach to eliminate all forms of malaria in Lao PDR and includes strengthened interventions targeted to the southern part of the country to reduce the primary malaria burden, while also expanding and enhancing efforts to eliminate malaria in low burden focal areas across the whole of the country.

The Ministry of Health, including the Department of Communicable Disease Control and the Centre for Malariology, Parasitology and Entomology (CMPE) with support from WHO and other technical partners, developed the new national malaria strategic plan in 2020, following an open and inclusive process that included a malaria program review in 2019.

In the last decade Lao PDR has experienced drastic reduction of the malaria incidence through concerted effort and targeted strategizing, with the burden reduce by over 85% since 2014. A very low malaria mortality rate has been maintained since 2009 which indicates that the program is well guided through its management and governance systems and through the continued support by the Government of Lao and by key health development partners, particularly Global Fund. The success of the program is a clear example of the collaboration required to tackle a significant public health problem with a clear goal and objectives, and the continuing reduction of the malaria burden in Lao is an achievement that should be used as a learning curve for other public health programs in the country.

In line with the Government's policies in the social sector, the Lao Government is placing a high priority on health services and will continue to aggressively push for the elimination of malaria under the Health Sector Reform Strategy and its commitment to achieve to Universal Health Coverage and fulfil the Sustainable Development Goals.

While challenges continue to threaten the malaria elimination goal in Lao PDR, it is the Ministry of Health's wish that continuing the strong momentum towards a malaria free environment is high on the Governments agenda. The Ministry of Health recognizes that that challenges such as human resources for health at all levels, the need to strengthen financial and administration systems, the building of technical and management capacity at the sub-national levels and the forecast reduction in external funding are critical to address during the implementation of the new national malaria strategic plan. However, there are opportunities to help address some of these systems constraints through the adoption of the new health reform strategies, especially in terms of strengthening sub-national capacity and improving delivery of primary health care services to the hard to reach and underserved populations, who in Lao PDR are at the highest risk of contracting malaria.

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Acronyms

ABER	Annual Blood Examination Rate
ACD	Active Case Detection
ACT	Artemisinin-Based Combination Therapy
ADB	Asian Development Bank
AFRIMS	Armed Forces Research Institute of Medical Science
AL	Artemether-Lumefantrine
API	Annual Parasite Incidence
APLMA	Asia Pacific Leaders Malaria Alliance
AS	Artesunate
BCC	Behavior Change communication
CBHW	Community Based Health Worker
CDC	Centers for Disease Control
CHAI	Clinton Health Access Initiative
CMPE	Centre For Malaria, Parasitology and Entomology
CSO	Community Service Organization
DFDA	Department of Food and Drug Administration
DHA+PIP	Dihydroartemisinin + Piperaquine
DHIS2	District Health Information System 2
DMR	Department of Medical Research
DoPH	Department of Public Health
EOC	Emergency operating center
EPHS	Essential Package Of Health Services
FDD	Food and Drug Department
FTAT	Focal test and treat
G6PD	Glucose 6-Phosphate Dehydrogenase
GF	Global Fund for AIDS, TB and Malaria
GIS	Geographical Information System
GMS	Greater Mekong Sub-Region
GP	General Practitioner
HIS	Health Information System
HMIS	Health Management Information System
HPA	Health Poverty Action
I/NGO	International/Non-Governmental Organization
iDES	Integrated Drug Efficacy Surveillance
IEC	Information, Education and Communication
IPL	Institut Pasteur du Laos

IP	Implementing Partner
IRS	Indoor Residual Spraying
LOMWRU	Lao-Oxford-Mahosot Hospital-Wellcome Trust Research Unit
LLIN	Long-Lasting Insecticide Treated Bednet
M&E	Monitoring And Evaluation
MCBR	Malaria Case-Based Reporting
MCBS	Malaria Case-Based Surveillance
MMP	Mobile and Migrant Population
MoH	Ministry of Health
NCLE	National Centre for Laboratory and Epidemiology
NGO	Non-Governmental Organization
NHP	National Health Plan
NMCP	National Malaria Control Program
NMEC	National Malaria Elimination Committee
NSP	National Strategic Plan
NMTG	National Malaria Treatment Guidelines
oAMT	Oral Artemisinin-Based Monotherapy
P.f	Plasmodium falciparum
P.v	Plasmodium vivax
PAMS	Provincial Anti-Malaria Station
PCR	Polymerase Chain Reaction
PMI	President's Malaria Initiative
PPM	Public-Private Mix
PQ	Primaquine
PR	Principal Recipient
PSI	Population Services International
P.V.	Pharmacovigilance
QA	Quality Assurance
QC	Quality Control
RAI	Regional Artemisinin Initiative
RAI2E	Regional Artemisinin Initiative 2 Elimination
RDSP	Regional Data-Sharing Platform
RDT	Rapid Diagnostic Test
RSC	Regional Steering Committee
SEARO	South East Asia Regional Office
SOP	Standard Operating Procedures
SR	Sub-Recipient

TES	Therapeutic Efficacy Studies
UHC	Universal Health Coverage
UNOPS	United Nations Office for Project Services
URC	University Research Company
VBDC	Vector Borne Disease Control
VHV	Village Health Volunteer
VMW	Village Malaria Worker
WHO	World Health Organization
WHO-GMP	WHO Global Malaria Programme
WPRO	WHO Pacific Regional Office

1. INTRODUCTION & COUNTRY PROFILE

1.1 Demography

The Lao People's Democratic Republic (Lao PDR) is a land-locked country bordering China, Vietnam, Cambodia, Thailand and Myanmar. The country comprises 18 provinces, which are further subdivided into 148 districts. The capital and largest city is Vientiane, which is situated on the Mekong River along the border with Thailand.

In 2019, Lao PDR has an estimated population of 7,231,210 and a population growth rate of 1.45%. Population density is low with an estimated 27 persons per sq. km in 2015 with an estimated average household size of 5.4 (2015 Lao National Census). Lao PDR has the youngest population in Asia, and more than half of Lao PDR's population (55%) is below 24 years of age. Only 28% of the population lives in urban areas.

There are 45 ethnic groups inhabiting Lao PDR. The official national language is Lao, though other ethnic minority languages are spoken in different parts of the country. The main religion in the country is Buddhism, practiced by approximately 67% of the population.

1.2 Environment and climate

Lao PDR is a highly mountainous country, with elevations frequently above 500 meters. The Annamite Mountain Range forms the border with Vietnam in the east, while another mountain range forms the border with Thailand in the northwest. The Mekong River forms a long border with Thailand in the western part of the country.

The tropical monsoon climate produces a significant rainy season which lasts from May until October. From November till February, there is a cooler, dry season, which is then followed by a hot dry season in March and April. There is a broad range of temperatures across the country, as areas along the Mekong River can reach 40° C during the hot season, or as low as 5° C during the cold season in the Northern parts of the country.

1.3 Socio-economic context

The economy began decentralization in 1986 and increased private enterprise has resulted in significant growth over the last 30 years. Lao PDR's strong economic growth led to an upgrade of the World Bank's classification from a "low-income" economy to a "lower middle-income" country. The gross national income (GNI) per capita was US\$ 2,460 in 2018. Averaging annual 8% GDP growth over the last decade, Lao PDR has become one of Asia's fastest growing economies.

The economy is heavily dependent on the natural resources available in the country (copper, tin, gold, gypsum, timber, rubber, etc.) and the hydroelectric power generated through foreign direct investment along with counterpart funding in dams along the Mekong River and its tributaries. These are exported to neighboring countries such as Thailand, China and Vietnam. Overall, approximately 73% of workers are employed in the farming/agriculture sector.

The economic growth is not equally distributed and is mainly concentrated in urban areas. Disparities between urban and rural areas are still pronounced. For example, 96% of urban households have access to electricity, compared with only 33% in rural areas without road access. Poverty is higher in remote and highland areas and inversely correlates with road or river access.

1.4 National health system and health sector reform

In January 2014, the National Assembly of Lao PDR endorsed a health sector reform (HSR) strategy and framework to establish a responsive health system and protect and promote the health of the people. The goals of HSR were to achieve the Millennium Development Goals (MDGs) by 2015, and to achieve Universal Health Coverage (UHC) by 2025.

Starting from a low base, the Lao PDR has achieved the MDGs, but the health status of the population is still lagging far behind other countries with a similar income level, due to problems of access to and quality of care. While there are ongoing efforts to manage communicable diseases and maternal and child health issues, non-communicable diseases and road traffic injuries, linked to ageing and changes in environment and lifestyles, are creating a double burden.

In 2019, MOH decided to review and update its strategy for the sector in 2021-2030. HSR is being updated to achieve UHC by 2025 and SDGs by 2030. The vision of MOH remains “Health for All By All,” implying that everyone and all sectors should help to achieve the best attainable health for all citizens. The mission statement, in line with the resolution of the 9th Party Congress, is “the promotion of healthy lifestyle, prevention of diseases, and access to quality health services that is affordable to all.”

The third phase of HSR (2021-2025) is envisaged to strengthen PHC through implementation of Sam Sang (3-builds) while laying the foundations for major governance reforms. The expected results include: (i) enhanced integrated health promotion and disease prevention at community level built around the model healthy village; (ii) the roll out of the essential package of health services at all levels, with high quality and sustainable financing strategy; and (iii) development of governance structure and legal/regulatory framework for governance reforms in the fourth phase. The fourth phase (2026-2030) is envisaged to implement those governance reforms, including hospital autonomy and private sector regulation.

In the era of the MDGs, health programs, financially supported by global health initiatives, delivered interventions for specific populations or diseases. In the era of the SDGs, and in the context of transition of donors such as Gavi and the Global Fund, there is recognition that this financing model may be limiting the ability of the Lao health system to adapt to the economic, demographic, epidemiological and even climatic transitions that it is facing.

Lao PDR is moving towards more integration within the health sector, to reduce fragmentation, duplication and misalignment across programs, and make the system more people-centered and sustainable. HSR, with its focus on PHC, will guide this transition.

2. MALARIA SITUATIONAL ANALYSIS

2.1 History of malaria control and elimination in Lao PDR

Malaria control began in Lao PDR in 1953, when the insecticide dichloro-diphenyl-trichloroethane (DDT) was first used. In 1954 a malaria control program was established at central level and all provinces had a DDT spraying team. From 1954, the National Malaria Service protected 900,000 people through household indoor spraying and a case management program utilizing chloroquine. However, the intensification of the Lao Civil War led to the cessation of spraying in 1961. From 1969 to 1975, some DDT spraying occurred in Vientiane Province along with campaigns of mass chloroquine administration.

The Institute of Malaria, Parasitology and Entomology was created in 1981 along with a country wide network of malaria units. This institute is now called the Centre of Malariology, Parasitology and Entomology (CMPE). Insecticide treated nets (ITNs) were first introduced in 1988 as the primary activity. By the mid-1990s, ITNs were scaled-up nationally with support of the World Bank and Asian Development Bank. Additional support was provided by the Laos-EU Malaria Control Program (1997-2001) and the government of Japan for targeted malaria control support in select provinces and districts. Bilateral Vietnamese government cooperation supported malaria activities in Nonghed district (Xiengkhouang province), Kamkheut district (Bolikhamxay province) and Ed district (Huaphan province) during this period.

By the early 2000s, the dynamics of malaria transmission was changing across Lao PDR, due largely to the beginning of several large malaria control projects with a focus on distribution of insecticide treated bed nets and utilization of artemisinin-based combination therapies (ACTs), resulting in reduction of malaria burden and more focalized transmission in the northern and central provinces, a trend that has continued to this current day. The malaria burden remained high in Southern Provinces, with spikes in incidence occurring due to the forest-going behavior, agricultural practices of village populations, the influx of migrant and mobile populations related to development projects and large scale industrial and agricultural projects.

2.2 Epidemiological profile

The parasite

Of the malaria cases reported in 2019 32% were *P. falciparum* infections. This continues a declining trend in the number of *P. falciparum* cases that have been detected in Lao since 2011, when over 90% of cases were attributed to this species. This is an expected progression as the country moves towards elimination and effective case management and vector control interventions have an increasing impact on *P. falciparum* transmission.

Increasing proportions of *P. vivax* being recorded in the country, including in some specific Northern provinces like Phongsaly, reflect the relative difficulty in controlling *P. vivax* due to its persistent liver stages (hypnozoites), which can only normally be cleared with a long course of primaquine (Fig.1).

It is important to note here the history in Lao, and in the Greater Mekong Subregion, of the spread of resistance within parasite populations to artemisinin-based combination therapies (ACTs), and the threat it poses to the country's elimination goal. Treatment failures have been reported to two of the six available ACTs during TES's conducted in Lao, Dihydroartemisinin-piperazine (DHAp) and Artemether-Lumefantrine (AL), however sample sizes for the AL study were so small that the final results are not considered robust. The emergence of artemisinin resistance in southern Lao PDR is also supported by the identification in 2013 and 2015-2017 of the presence of K13 mutants (mainly C580Y, Y493H and R539T) in some parasite populations. The monitoring of parasite resistance against AL is continuing in 2019-2020 in high burden areas and results will support the National Program's decision to ensure appropriate changes to malaria treatment policy and help to detect early changes in Pf sensitivity to antimalarial drugs.

Figure 1. Distribution of *P. falciparum*, mixed and *P. vivax* in Lao PDR (2010-2019)



The vectors

There are four recognized malaria vectors in Lao PDR. *Anopheles dirus* and *An. minimus* are primary vectors and *An. maculatus* and *An. jeyporiensis* are secondary vectors. *An. dirus*, which is the most efficient vector, cannot survive without dense shade and high humidity. Deforestation therefore generally leads to substantially reduced malaria transmission. *An. minimus*, which is the next most efficient vector, is also primarily forest-based but can survive in less densely shaded forest, forest fringes and in the patchy bamboo thickets that commonly persist post-deforestation. *An. minimus* is widespread and has been identified in all provinces. The two secondary vectors occur in areas of irrigated open farmland and in flooded rice fields and sporadic secondary transmission can take place in these areas as a result of imported cases.

Both indoor and outdoor biting takes place, but primary vectors are characterised, at least seasonally, by their early evening outdoor biting habit. This is a key feature of the epidemiology of malaria throughout the Greater Mekong Sub-region (GMS), which limits to some extent the effectiveness of key interventions for vector control and personal protection. A recent 24-hour static landing catch study in Cambodia revealed very significant levels of day-biting in *An. dirus* and this daytime biting behaviour likely explains a recent outbreak in Lao PDR's Savannakhet Province amongst families foraging in the forest during the daytime. This has very serious implications for the development of effective tools for personal protection from malaria in forest settings.

Transmission

The vast majority (95%) of cases are concentrated in the southern five provinces: Savannakhet, Saravane, Sekong, Champasack, and Attapeu. Malaria transmission in the northern provinces is low and sporadic. This is partially explained by the fact that the intensity of transmission varies greatly between the different ecological zones, from low transmissions in the plains along the Mekong River and in areas of high altitude (greater than 1000m) to intense transmission in hilly forested areas. Urban zones and villages located at altitudes above 1200m are generally considered free from malaria; however very few studies have been performed in villages in high altitudes. The tropical climate in Lao PDR with an average annual temperature of 25-30° C and average humidity of 55% is highly suitable for transmission of malaria. However, in some areas in the Northern part of the country, temperatures regularly drop below 18° C in the cold season and at these times transmission may be temporarily interrupted.

Historically, malaria transmission in Lao PDR has been characterized by clear, seasonal peaks coinciding with the rainy season from April to October. However, with less stable and increasingly focal transmission primarily restricted to the southern parts of the country, where 95% of the malaria burden is now located, this seasonality is now less pronounced. Intense transmission in certain foci can sometimes extend into December and January.

Key Risk Populations

There are a wide variety of mobile and static population groups at risk of malaria in endemic areas of Lao PDR. The epidemiology of the disease varies considerably from one group to another and may require different malaria control strategies, adapted to risk group behavior, local cultural and traditional practices, local health infrastructure, and environmental conditions. The level of malaria risk for each of these groups varies according to a number of location-dependent factors including degree of endemicity, accessibility, health system strength and poverty. Villages that are located within the high malaria risk forested areas of Lao PDR belong to a broad range of ethnic minority groups. There are 240 distinct languages spoken in Lao PDR making communication of health messages extremely challenging. Poverty in these communities is often extreme.

2.3 Current situation and trends

While the overall malaria trend is downward, the disease is still considered an important public health problem in Lao PDR and the country remains at risk of epidemics. The number of malaria cases decreased between 2001 and 2019, from 279,903 cases to 6,409 cases. After point of care diagnostics (RDTs) were introduced in 2012 there was an increase in cases detected, however since then program has continued to maintain impact with annual declines in case numbers (Fig.2). Malaria deaths have decreased from 44 reported in 2012 to 6 deaths in 2018 and zero deaths in 2019.

Figure 2. Trend of annual malaria cases 2009-2018

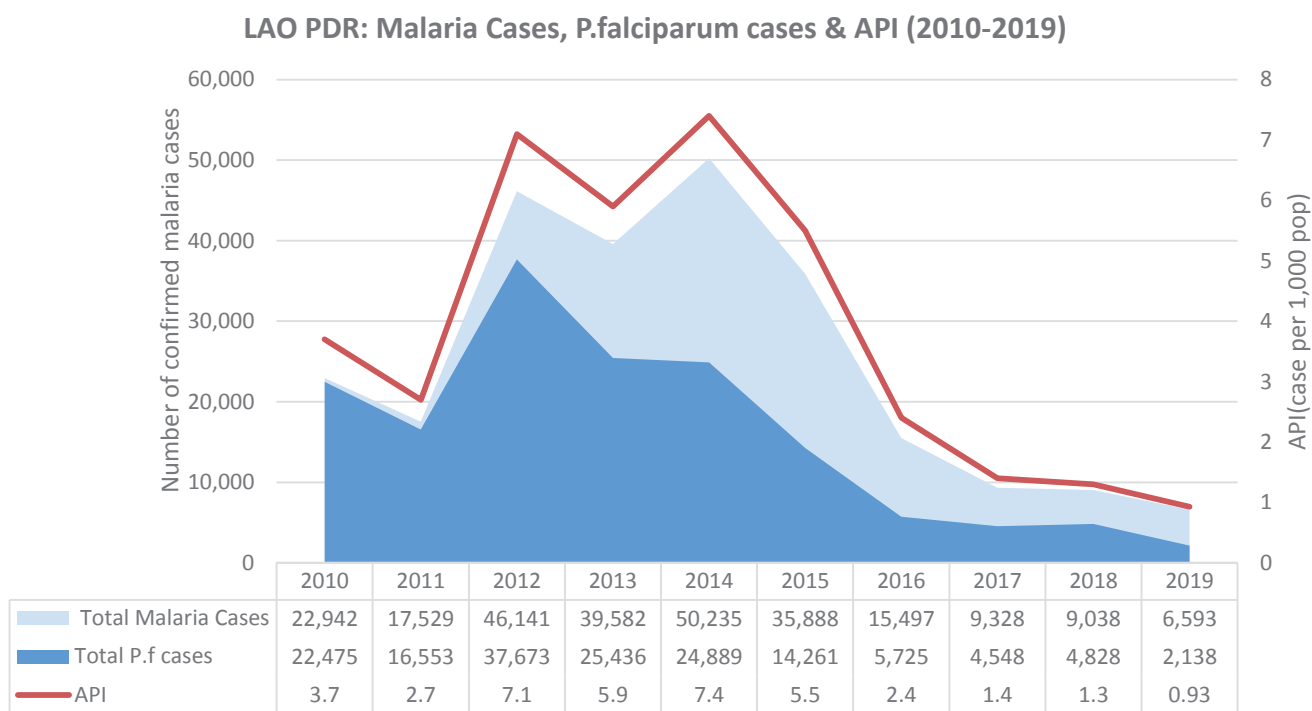
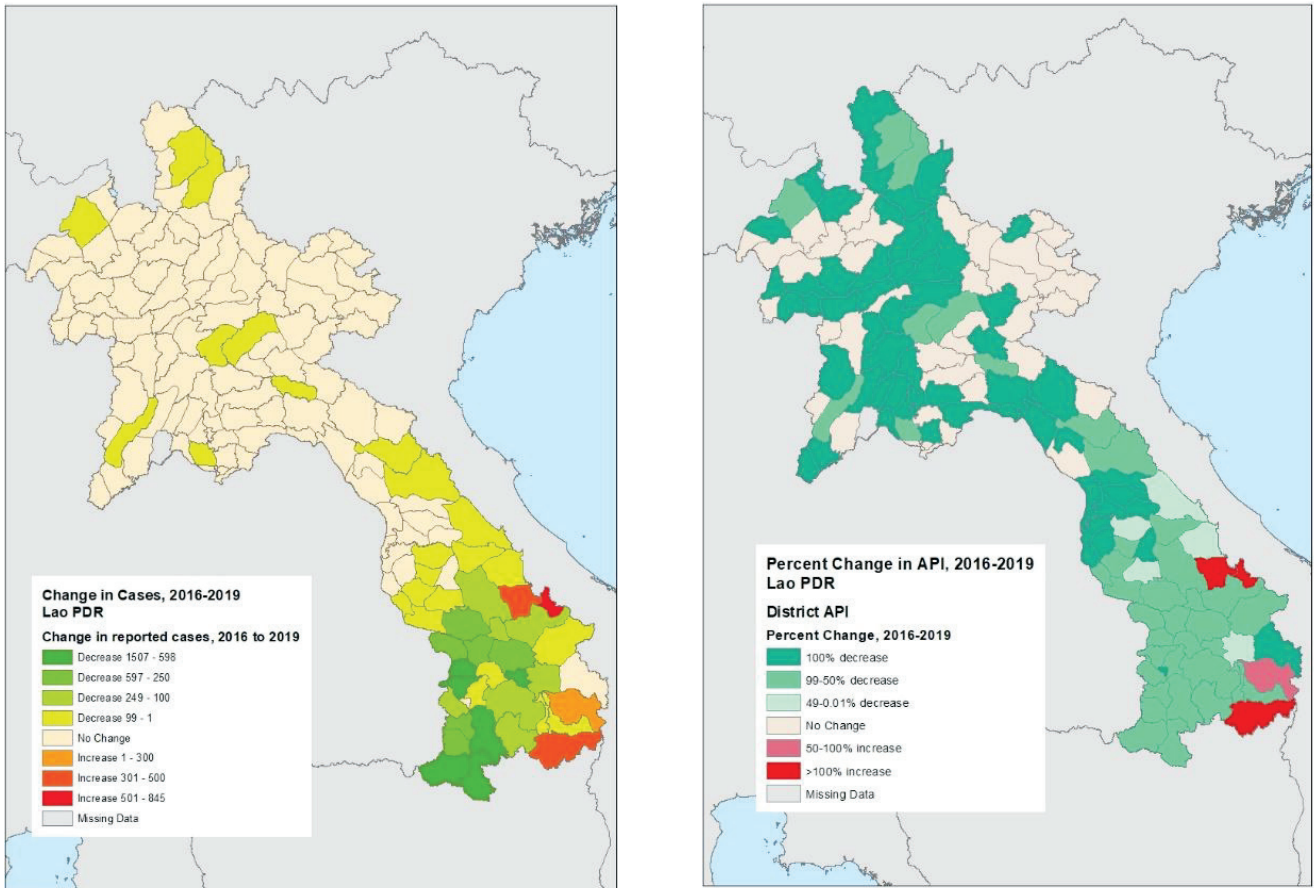
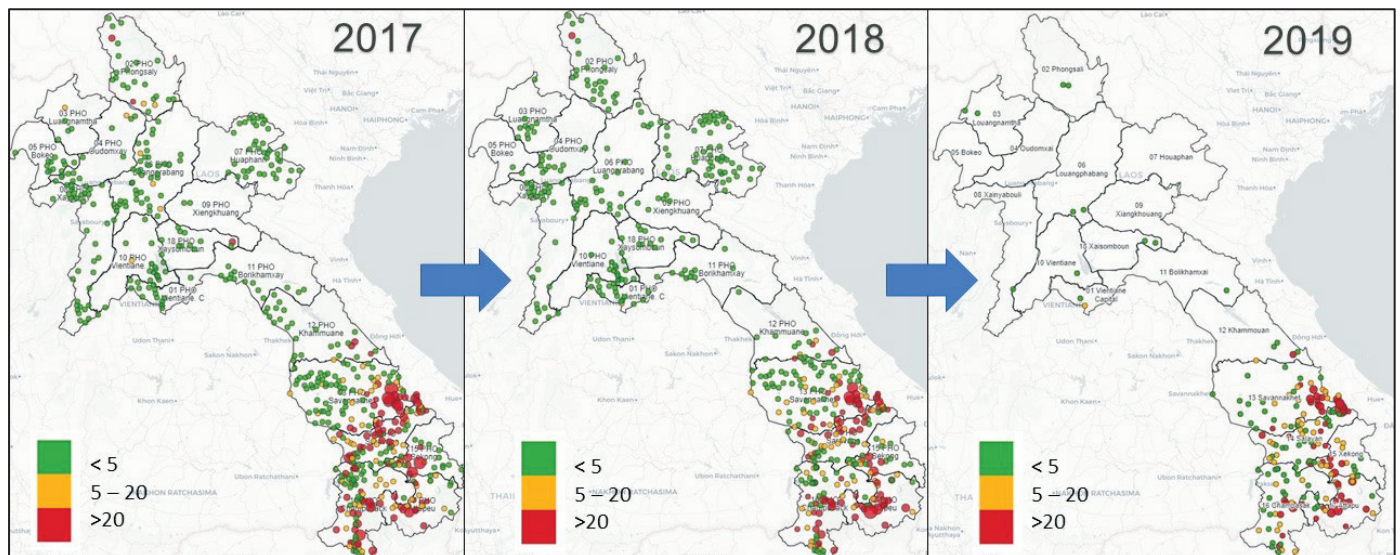


Figure 3. Changes in API & whole case numbers from 2016 to 2019.



Much progress has been made particularly during the last four years to reduce the malaria burden (Fig.3). The series of maps in figure 3 illustrate geographically the progress that has been made towards elimination since 2017 (Fig.4).

Figure 4. Changes in caseload by Health Facility Catchment Area from 2017 to 2019.



The most recent stratification exercise conducted in 2019 included a two-step process: a district level API-based stratification using data from January 2017 to September 2019 to determine whether districts should be focusing on burden reduction activities (API>1) or elimination activities (API<1) (table 1); and a HFCA level caseload-based stratification to identify HFCA within each district in need of intensified intervention packages. A risk map using a predictive model based on demographic, environmental and other ecological data was also used to complement and

validate the case data. The classified HFCA into four strata based on caseload during the previous two years and nine months: Stratum 1, malaria free; Stratum 2, low risk (<5 cases); Stratum 3, moderate risk (5-20 cases); and Stratum 4, high risk (>20 cases).

Table 1: District level API-based stratification of malaria risk.

No	Province	No. of Districts	Elimination API <1	Burden Reduction API > 1
1.	Vientiane C	09	09 (100 %)	0
2.	Phongsaly	07	07 (100 %)	0
3.	Luangnamtha	05	05 (100 %)	0
4.	Oudomxay	07	07 (100 %)	0
5.	Bokeo	05	05 (100 %)	0
6.	Luangpraband	12	12 (100 %)	0
7.	Huaphanh	10	10 (100 %)	0
8.	Xaybury	11	11 (100 %)	0
9.	Xiengkhuang	07	07 (100 %)	0
10.	Vientiane. P	11	11 (100 %)	0
11.	Borikhamxay	07	07 (100 %)	0
12.	Khammuane	10	10 (100 %)	0
13.	Savannakhet	15	11 (73.3 %)	4 (27.7 %)
14.	Saravane	8	1 (12.5 %)	7 (87.5 %)
15.	Sekong	4	1 (25 %)	3 (75 %)
16.	Champasack	10	3 (30 %)	7 (70 %)
17.	Attapeu	5	0	5 (100 %)
18.	Xaysomboun	5	5 (100 %)	0
Lao PDR		148	121 (82%)	27 (18%)

The 2019 stratification exercise indicated that 121 of Lao PDR's 148 Districts should focus on elimination while the remaining 27 should focus on burden reduction (Table 1). After adjusting the initial HFCA analysis to account for data gaps, and then applying predictive modelling to these results, a final list of HFCA stratification assignments was produced. There were 1,229 health facility catchments that qualified for the analysis, of which 752 (61.2%) are malaria free (stratum 1), 196 (15.9%) are low risk (stratum 2), 96 (7.8%) are medium risk (stratum 3) and 185 (15.1%) are high risk (stratum 4) (Table 2). Saravane Province has the highest number of high risk HFCA (48), while Attapeu is the only Province that has no malaria free catchments at all. There are ten provinces that contain no high-risk strata and, among these, three provinces have no medium risk catchments.

Table 2: Health Facility Catchment Area level caseload-based stratification of malaria risk.

Strata	Classification	Definition	No. of HFCAs	Percentage
<i>Stratum 1</i>	Malaria Free	HFCAs with no cases	752	61.2 %
<i>Stratum 2</i>	Low risk	HFCAs with <5 cases	196	15.9 %
<i>Stratum 3</i>	Moderate risk	HFCAs with 5-20 cases	96	7.8 %
<i>Stratum 4</i>	High risk	HFCAs with >20 cases	185	15.1 %

Results of the 2019 stratification exercise were used to guide the allocation of interventions and the costings of these interventions for the 2021-25 National Strategic Plan. However, the program will continue to adjust these allocations depending on the evolution of malaria transmission patterns.

3. STRATEGY AT A GLANCE

3.1 Vision

A malaria-free Lao PDR by 2030

3.2 Mission

The Lao PDR Government's malaria mission is to collaborate with all related line ministries, neighboring countries and partners, to empower the health system and communities to eliminate malaria and prevent its re-establishment.

3.3 Strategic goals

Phase one (2021-2025)

The phase 1 goal of the National Strategic Plan (NSP) is to eliminate Plasmodium falciparum malaria in the entire country and to eliminate all species of malaria in the 13 northern provinces.

- Eliminate the transmission of P. falciparum in the 13 Northern provinces by 2021.
- Eliminate the transmission of P. falciparum in the entire country by 2023.
- Eliminate the transmission of P. vivax in the 13 Northern provinces by 2025.
- Reduce the incidence of indigenous cases of P. vivax to <1 per 1,000 in the Southern provinces by 2025.
- Prevent re-establishment of malaria in areas where it has been eliminated

Phase two (2026-2030)

The phase 2 goal of the NSP is to eliminate malaria by 2030 in the entire country.

- Eliminate the transmission of malaria in the entire country by 2030.
- Prevent re-establishment of malaria in areas where it has been eliminated.
- By 2030, initiate the process for certifying malaria free status.

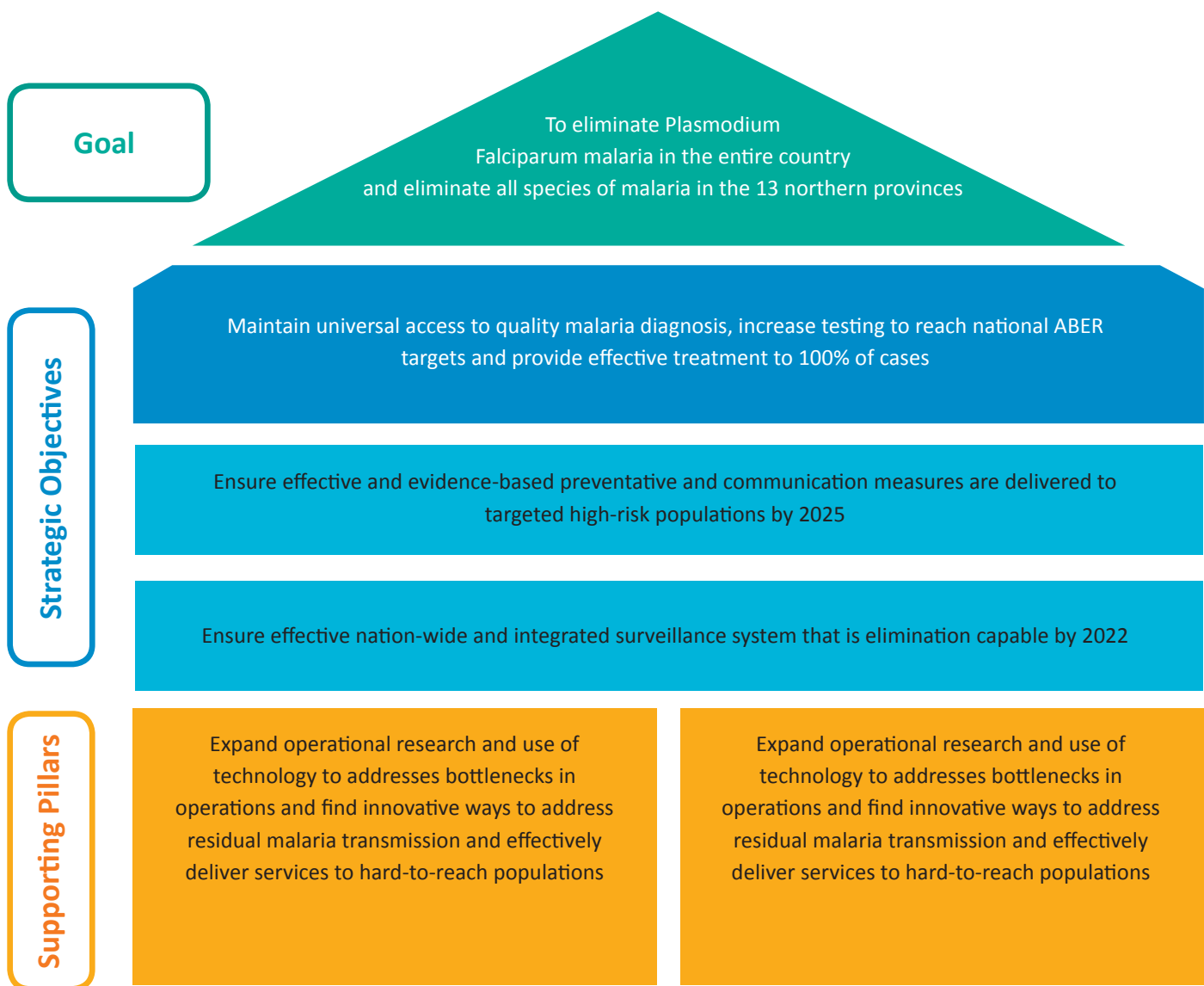
3.4 Programmatic objectives and supporting elements

Strategic objectives

- 1: Maintain universal access to quality malaria diagnosis, increase testing to reach national ABER targets and provide effective treatment to 100% of cases
- 2: Ensure effective and evidence-based preventative and communication measures are delivered to targeted high-risk populations by 2025
- 3: Ensure effective nation-wide and integrated surveillance system that is elimination capable by 2022

Supporting elements

- 4: Expand operational research and use of technology to addresses bottlenecks in operations and find innovative ways to address residual malaria transmission and effectively deliver services to hard-to-reach populations
- 5: Strengthen the enabling environment by building sustainable HR, program and financial management capacity, coordination and alignment of partners and greater empowerment at the district level



3.5 Principles

- Building country ownership and leadership and mobilizing partnership action by the Ministry of Health and the National Malaria Program with the participation of communities, other implementing partners, technical agencies and the private sector, are essential to accelerate progress through a multi-sectoral integrated approach.
- Malaria elimination will be accelerated through combinations of integrated interventions adapted to Lao PDR context and responding to local needs.
- Adequate malaria case-based surveillance, investigation and response is required to enable elimination and sustain prevention of re-establishment.
- Improved entomological surveillance and investigation is required to support evidence-based vector control operations and the acceleration of elimination.
- Information systems that facilitate malaria stratification (to monitor progress, evaluate anti-malaria interventions and support planning) are required to optimize implementation of malaria interventions.
- Equity in access to services, irrespective of ethnicity, nationality or gender is essential, especially for the high-risk groups for malaria including vulnerable and hard-to-reach populations.
- Innovation in tools and implementation approaches will help to maximize progress.
- Enhanced regional collaboration will be required to reach sustained elimination in the GMS.

4. STRATEGIC OBJECTIVES AND SUPPORTING ELEMENTS FOR PHASE 1

4.1 Strategic objectives

Strategic objective 1: Maintain universal access to quality malaria diagnosis, increase testing to reach national ABER targets and provide effective treatment to 100% of cases

Providing timely and appropriate quality management of all malaria cases is a key component of malaria control and elimination, and a key tool to fight the spread of artemisinin resistance. Quality assured diagnosis by microscopy or RDT and prompt, effective treatment of all malaria cases according to updated national malaria treatment guidelines will remain a key priority, supported by training and supportive supervision of health workers, and ensuring universal access throughout Lao PDR. Radical anti-relapse treatment for *P. vivax* will be a particularly high priority to eliminate all remaining parasites.

Strategic intervention 1.1: Ensure high level of diagnostic testing of suspected cases for malaria to reach and maintain at least 10% ABER for burden reduction areas and 3% for elimination areas

A high level of diagnostic testing of suspected cases for malaria will be ensured, aiming to reach an annual blood examination rate (ABER) of at least 3% in elimination areas and 10% in burden reduction areas. While ABER is generally already high in the high-transmission areas in the south (current average >11%), the malaria testing rates need to increase in the malaria elimination areas in the north (current average around only 1.5%). This is a key activity to be able to detect all remaining cases and treat them quickly to interrupt transmission.

To support and promote high malaria testing rates at all levels, adequate supplies of diagnostic materials in all health facilities will be ensured and health workers will receive regular training and re-training, and on-site supportive supervision, stressing the importance of testing all suspected cases, and avoiding any presumptive malaria treatment without prior parasitological diagnostic testing.

The current split in the use of microscopy and RDTs at different health facility levels will be maintained. Microscopy will continue to be used as the main diagnostic methods at hospital level, whereas malaria RDTs will primarily be used at health centers and lower level clinics, in burden reduction areas, in elimination areas and in areas that are malaria free but remain receptive. High-quality malaria microscopy services will be maintained in provincial and district hospitals in the elimination areas.

To support case detection in patients with very low parasite burden, the use of more sensitive diagnostic methods will be explored through operational research. For example, use of highly-sensitive RDTs may be introduced in elimination areas, depending on their proven comparative advantages taking into consideration their cost-effectiveness and operational limitations relative to standard RDTs and microscopy.

Strategic intervention 1.2: Provide efficacious treatment of all confirmed *P. falciparum* cases with an ACT and a single-low-dose primaquine treatment.

To ensure that proven effective antimalarial treatment is always used, the National Malaria Treatment Guidelines (NMTG) will be updated based on the latest available results from therapeutic efficacy surveillance (TES) conducted in sentinel sites, as well as results from genetically mapping the distribution and spread of resistant parasites. Annual NMTG review meetings will be held, and any required changes in 1st and 2nd line treatment will be adopted and implemented swiftly, including also revision of the national Essential Medicines List (EML) in close collaboration with the Food and Drug Department (FDD). CMPE will work with the FDD to ensure that as many different ACT products as possible get registered in Lao PDR, in order to allow a rapid administrative, operational and clinical switch in treatment policy implementation whenever necessary.

Training and on-site supportive supervision for health workers, both in public and private facilities and in communities, will be ensured, emphasizing the importance of adhering to NMTGs. Particularly strong attention will be given towards appropriate use of primaquine, i.e. single-dose primaquine for *P. falciparum* transmission prevention.

Discussions will be held with the Health Care Department (HCD) on potential future integration of NMTGs into the wider National Standard Treatment Guidelines.

Strategic intervention 1.3: Ensure effective and safe radical cure treatment for all P. vivax cases

To facilitate the elimination of *P. vivax*, strong emphasis will be made on ensuring effective and safe anti-relapse treatment for all *P. vivax* cases. This involves the correct administration of primaquine using either a weekly regimen over 8 weeks or a daily regimen over 14 days. The latter is preferable in terms of optimizing patient compliance with the full course of treatment but risks causing acute hemolytic anemia in glucose-6-phosphate dehydrogenase (G6PD) deficient patients and so is dependent on prior testing of G6PD deficiency status. So far, the use of G6PD rapid tests and administration of primaquine has been limited to hospital level. However, if pilot implementation studies within targeted Health Centers (HCs) in high burden areas demonstrate that the administration of primaquine based on G6PD rapid testing (either qualitative RDTs or quantitative POC tests) can be safely implemented at HC level, then this approach may be scaled-up, supported by the required health worker training and supervision. Having broader access to G6PD quantitative tests is also in the interest of gender-based programming as females are excluded from having G6PD tests before PMQ prescription when only G6PD RDT qualitative RDT tests are made available at the health facilities, which results in females always receiving longer regimen of PMQ 8 weeks.

To that effect, the monitoring and evaluation mechanisms (M&E) for the implementation of pilot projects supporting *P. vivax* qualitative G6PD rapid testing and primaquine administration at lower levels of the health system, such as the focal testing and treatment, focal test and treat (FTAT) project, will be strengthened. Outcomes of pilot projects will inform and guide potential wider use and roll-out as part of national malaria treatment policy.

Based on the results of the pilots and operational research, the malaria program will strategically expand G6PD rapid tests and administration of primaquine from Hospital level to Health Center level. Different roll-out strategies for the different types of G6PD rapid tests now becoming available (i.e. qualitative and quantitative) in different settings will be explored. As a means to scale-up radical treatment for *P. vivax* in areas and settings where G6PD testing is not available, the regimen of weekly primaquine for 8 weeks will be promoted together with appropriate compliance support. In high-burden areas, strengthening the referral of *P. vivax* patients from private providers to health centers or hospitals for diagnosis of G6PD status and subsequent appropriate radical treatment will also be explored.

Strategic intervention 1.4: Maintain strong vigilance of artemisinin resistance by implementing high-quality antimalarial therapeutic efficacy surveillance (TES) in sentinel sites and iDES piloting

In the light of artemisinin resistance spreading rapidly in the region, strong vigilance will be maintained towards implementing high-quality antimalarial therapeutic efficacy surveillance (TES) in sentinel sites, following standard WHO manuals and supported by the necessary training, supervision and QA activities in the field. TES results will be used to update NMTG in a timely manner. The regional perspective on spread of artemisinin resistance within the GMS will be given high priority, emphasizing joint training, coordinated TES implementation and exchange of timely information including latest TES results.

Priority will be given to TES implementation in the high-burden provinces located in the south, especially those that are adjacent to areas facing high artemisinin resistance rates in neighboring countries, and where the caseload is still high enough to implement TES within a reasonable period of time.

In areas where malaria cases are declining and monitoring of treatment efficacy through standard TES is therefore difficult, integrated drug efficacy surveillance (iDES) will be piloted.

Relevant molecular markers will be used as an additional means to monitor the spread of artemisinin resistance in Lao PDR. The required molecular studies will be conducted by CMPE in collaboration with national technical partners, such as IPL and regional technical partners.

Strategic intervention 1.5: Implement Quality assurance and quality control (QA/QC) at all levels

Comprehensive quality assurance and quality control (QA/QC) systems for malaria microscopy will be improved and maintained at all relevant levels, implementing updated standard operating procedures based on the latest WHO guidelines, and supported and monitored as part of routine program management.

QA/QC of microscopy is particularly crucial during elimination when microscopists see fewer and fewer positive slides and it becomes progressively more difficult for them to maintain their skills. The program will invest special effort in strengthening microscopy QA in support of elimination. To ensure high-quality malaria diagnosis, QA/QC measures for malaria microscopy will be strengthened through implementation of updated microscopy IQA guidelines. Activities will include routine cross-checking of slide results as well as periodic supervision visits. External competency assessments (ECAs) of malaria microscopists will be conducted regularly. A national malaria slide bank facility will be established in collaboration with regional partners (e.g. RITM, Manila) in order to maintain the skills of microscopists in the face of falling numbers of malaria-positive blood slides.

The quality control system for RDTs will be strengthened by re-starting the routine lot testing for all arriving batches. Attention will also be given to correct transportation, handling and storage of RDTs and medicines to safeguard their technical functionality/efficacy.

Robust supervision is the key to QA of patient care and will be applied with clear protocols in accordance with the NMTGs and monitoring systems for both public and private sectors. Reviews of all malaria case management practices will be carried out in facilities suspected of underperforming (based on reports or data analysis) and remedial measures will be put in place where appropriate (including special needs-based training for clinical staff).

To ensure high safety standards in malaria treatment, the strengthening of the pharmacovigilance system will be supported in collaboration with FDD and DHC. Specific focus will be made on revising a set of SOPs and protocols on pharmacovigilance processes in case of malaria events due to primaquine or ACTs.

Strategic intervention 1.6: Monitor availability of oral artemisinin monotherapy (oAMT) and counterfeit malaria medicines

In collaboration with the FDD, the availability of oral artemisinin monotherapy (oAMT) and other non-recommended antimalarial medicines will be continuously monitored by surveillance and sample collection from private providers (pharmacies, drug outlets, clinics and hospitals), especially among those located in border areas.

Monitoring the availability of counterfeit medicines among private providers will likewise be implemented, including pharmacological testing of collected specimens in regional WHO collaborations centers in collaboration with the regional USP/PQM program. This will be supported by hands-on training and supervision, in collaboration with WHO and other technical partners.

Strategic intervention 1.7: Strengthen the role of VMWs in conducting integrated community case management (iCCM)

Ensuring continued access to quality malaria case management at community level within high-burden areas through the Village Malaria Worker (VMW) system will remain a key priority and activity. Hence, support to VMWs through training and a well-functioning on-site supervisory system, with adequate financing and infrastructure support, will be given high priority. As malaria declines, a wider role of VMWs in the daily management of other health problems in their community will be explored in collaboration with other health departments. A consolidated manual describing all roles and responsibilities of VMWs will be developed.

Providing case management services for mobile populations and migrant populations spending time in endemic and high transmission risk settings is essential. Elimination will not be achieved unless these population groups have access to free early diagnosis and appropriate treatment. A large proportion of these high-risk populations live in remote villages and these populations will be catered for primarily through the static VHVs/VMWs based in these villages. As such, the risk stratification will be updated and used to ensure that VMWs are placed in the areas most at risk of malaria. In addition, volunteers will deliver monthly BCC messages through public announcement systems in selected high-risk villages. However, the static approach, i.e., Malaria Post or VMWs stationed in villages, to provide malaria case management services to MMPs (Mobile Migrant Populations) may not adequately provide services to these populations throughout the year, so other proactive and innovative service delivery models such as Mobile Malaria Workers, work site malaria volunteers, MMP peers and forest goers peers will be also explored.

Strategic intervention 1.8: Provide malaria diagnosis and treatment services for high-risk population, such as Migrant Mobile Populations, forest goers, ethnic minority groups, workers at infrastructure projects.

In addition to the critical work done by VHVs/VMWs to reach the at-risk hard-to-reach population to quickly detect and treat infections, the program will continue to explore innovative ways to increase access to these risk groups (e.g. forest goer package, FTAT, MMWs, cross-border checkpoints, etc.) to case management services. These interventions and strategies will be investigated and implemented where suitable and where they can have the biggest impact.

Due to the variable epidemiological profiles within Lao and the diverse host (including cultural diversities) and vector behaviors and ecologies that drive this variability, it will be important for the program to adopt flexible and contextualized approaches to reaching these populations, rather than a one size fits all approach. Potential strategies that will be explored include: expanding the roles and responsibilities of the VMWs to conduct outreach work during risk periods (rice and crop harvesting); conducting targeted testing of high risk forest going populations through village based focal test and treat and/or reactive screening around index cases; placing Mobile Malaria Workers (MMWs) at key travel routes for high risk population; and access to quality case management for migrant workers at high risk work sites.

Areas with intensive and ongoing transmission will be eligible for application of these strategies, either individually or in combination, and will be investigated to assess what approach/es will provide the highest impact. The program will ensure to provide all VMWs of MMWs with malaria commodities, trainings and routine supervisions.

The malaria program will also meet with the developers of large infrastructure projects to assess opportunity to train their medical team on testing and treatment guidelines and ensure that they conduct routine active case detection on a quarterly basis at the worksite.

Finally, depending on the results of operational research on forest goers' packages and novel vector control tools, the program will consider procuring and distributing forest packs and repellents in targeted areas.

Strategic intervention 1.9: Maintain Private sector (PPM) in high burden areas and transition PPMs responsibilities in elimination areas

It is estimated that one fifth of malaria cases in Lao PDR are treated in the private sector. To respond to this, CMPE has extended access to appropriate malaria case management through its PPM program, which commenced in 2008. As part of this approach the MoH, with the operational support of partners, completed a national initiative to centralize the procurement of drugs, in both the public and the private sectors. Furthermore, only registered private clinics and pharmacies are now authorized to provide malaria services and they must adhere to the NMTGs. Together these approaches have resulted in decreased utilization of fake and sub-standard drugs.

The PPM will be maintained and expanded as necessary in burden reduction areas to cover both formal and informal providers (e.g. village shops and itinerant drug providers), however care will be taken to ensure there is no overlap of service provision between village shops and VMWs. This approach will also include strengthening the surveillance component in outlets to ensure that all cases are reported on a monthly basis in the MIS DHIS2.

The current PPM network approach in high-burden and transition areas will be maintained, emphasizing local government ownership (in data management, commodities supply, QA/QC and supervision). In elimination areas, the PPM network will be maintained in supporting malaria case detection¹, notification and referral. Likewise, the role of PPMs in prevention of re-establishment and in responses to outbreaks will be strengthened.

Enforcement of the current regulations concerning malaria case management outside of official health care facilities (FDD and HCD) will be ensured as a mean to maintain rational and high-quality malaria diagnostic procedures and treatment practices in the face of spreading artemisinin resistance. At the same time, innovative ways of engaging strategically with private pharmacies and clinics (which are not a part of the PPM network) in provision of malaria 'services', under the oversight of FDD (for private pharmacies) and HCD (for private clinics and hospitals), will be explored, as a means to detect and treat all malaria cases early to prevent onwards transmission.

Strategic intervention 1.10: Continue to support the military health care providers with malaria diagnosis, treatment, reporting, training, monitoring & evaluation, and QA/QC

The national malaria program will continue to support military health care providers in all aspects of malaria diagnosis and treatment, reporting, training, M&E, and QA/QC. Specific approaches to collaborate and address malaria within the military sector, for personnel deployed in endemic areas will be applied in collaboration with the Ministry of Defense (MoD). Microscopy or RDT based malaria screening and treatment will be introduced for all defense service personnel before and after deployment/redeployment to endemic areas.

Strategic objective 2: Ensure effective preventative and communication measures are delivered to targeted high-risk populations.

Strategic intervention 2.1: Distribution of LLINs to 100% of targeted high-risk population

Providing personal protection measures to the populations most at-risk of malaria infection is a priority for malaria control and long-lasting insecticidal nets (LLINs) are the primary personal protection measure used in Lao PDR. CMPE will use LLINs to prevent exposure of at-risk populations to vectors to control the disease and reduce the burden in high-incidence areas.

Current strategies include delivery of family size LLINs every three years to targeted high risk populations (based on risk strata) through mass distribution; annual continuous distribution of family size LLINs to pregnant women, and single size LLINs to mobile and migrant populations (MMPs) as well as the military and other formal sector forest goers such as forest and wildlife protection personnel.

The next mass distribution will be programmed for 2022 and will be conducted between January and April prior to the start of the peak transmission period in May. Final quantification and distribution strategies will be determined at least 12 months prior to the planned distribution period. Intensive bottom-up microplanning of the distribution logistics and operations will be conducted with provinces and districts 6 months prior to distribution.

The previous year's annual re-stratification data (which will be available at village level) will be used for microplanning to determine which high-risk populations to target. In the rest of the country, where populations are at less risk, only active foci or villages in outbreak areas that are not protected, as well as populations in major development projects that are likely to attract MMPs will receive nets.

The current coverage rate of 1.8 people per LLIN for mass distribution planning does not adequately protect the targeted population as residents of some households sleep separately (especially in ethnic minority villages). To cater for this behavior and to provide more even coverage rates in subsequent mass campaigns, CMPE will conduct field evaluations determine whether 1.8 is appropriate for all contexts in Lao. Single nets will make up 20% of the overall net allocation, and this percentage will be revisited after the LLIN use survey.

¹ The program will not supply private pharmacies with diagnostic tests as part of the PPM, but can still test and must remain part of the "elimination effort".

CMPE will mobilize Ministry of Health funding to procure small batches of LLINs in interim years for continuous distribution via health centers primarily for pregnant women (ANC) and MMPs and for new residents to high-risk areas.

Additional strategies to provide better protection of the targeted populations with LLINs include:

- increasing the number of single nets for MMPs through the continuous distribution channels, and using a bottom up approach in consultation with provinces, districts and CSOs to estimate the number of nets for this cohort;
- having a stockpile of emergency nets available centrally and in key provinces for active foci response, outbreak response and public health emergencies (i.e. flooding, displacements);
- providing LLINs for all beds in health facilities in high transmission risk settings.

To ensure that the program is achieving the highest access, coverage and usage of LLINs, a specific focus will be made on conducting monitoring and evaluation activities post distribution. These will include conducting surveys and assessments through site visits to confirm coverage and access rates, conducting net preference and use survey, along with insecticide resistance and LLIN durability studies. These M&E activities will be conducted and tailored as required, depending on the context and the type of LLINs procured.

Specific IEC/BCC materials will also be developed to ensure uptake of the intervention by at-risk population. Different medium of communication and activities will be implemented at community level, which will be tailored to the right target audience. For population in at-risk villages, forest-goers and MMPs, a focus will be made toward designing strong messages and training VMWs and village heads to disseminate the information through community events and loudspeakers. Case management staff and volunteers will also work together to implement village-based BCC campaigns during mass LLIN distribution. The manufacturer selected for procurement of LLINs will also be requested to add in each LLIN package a pamphlet with instruction on how and why to use LLINs, translated in local language. Posters will be added outside markets, bus station, cross-border check points and billboards in high burden districts. The malaria program will collaborate with partners to develop and launch a social media campaign at the time of the mass LLIN distribution, and with the military medical department to launch radio programs on the military channels on LLINs and LLIHNS.

Strategic intervention 2.2: Targeted IRS applied in outbreak and active foci villages or as an emergency preventative measure.

WHO recommends that only one core preventative method should be used in any given area. Additional preventative measures are only recommended in certain situations. Lao PDR is using LLINs as its core intervention and so will only apply IRS in addition to LLINs in an outbreak, active foci (if LLINs are unavailable) or other emergency response setting.

IRS will be conducted in targeted villages and temporary shelters that are identified as:

1. Active foci in elimination districts (as part of the response package in the national elimination surveillance and response guidelines) but only if LLINs are not available for distribution or where LLINs are available but usage is very low;
2. Outbreaks (as designated by the DHIS2² outbreak alert system) in high burden districts (as part of the response package in the national burden reduction surveillance and response guidelines).

In accordance with the national policy the choice of insecticide will take into account safety, efficacy, cost, availability and susceptibility of vectors. There will need to be continued oversight and capacity building of provincial and district teams by CMPE and partners to ensure that IRS operations are implemented effectively and that spray teams adhere to the current national IRS SOPs.

² District Health Information System 2.

Entomological impact of IRS will be periodically assessed by CMPE's Entomology Section through pre- and post-intervention vector surveillance operations. These assessments will support the development of an evidence base on the impact and effectiveness of the prescribed response packages in targeted areas.

Strategic intervention 2.3: Conduct routine entomological surveillance, including insecticide resistance monitoring

Large scale entomological surveillance in Lao PDR has been limited due to the lack of capacity and human resources. There is some bionomic and resistance data available from previous operations which indicates that there is no resistance in the primary or secondary vectors to synthetic pyrethroids that are used in LLINs and IRS. Resistance testing can only be conducted in an ad hoc manner due to the challenge of collecting sufficient vector mosquito specimens in the field, however the program will continue to monitor the potential emergence of insecticide resistance when possible. Recent bionomic data collected from high burden villages indicates that primary and secondary vectors are biting in significant numbers not just in forest locations around these villages but also in the villages themselves (indoors and outdoors).

Entomological surveillance data becomes more critical as the country moves towards elimination, as this information can be key to determining risk areas. As vector control interventions scale down, resistance monitoring becomes less of a priority and the ability of the program to collect bionomic data to inform focus investigations and risk assessments increases. The priority for malaria entomologists in elimination settings is epidemiology-led entomology for problem solving. Entomological efforts must concentrate on identifying why transmission is persisting in persistent transmission foci, and on ensuring that the program takes appropriate evidence-based action to address any problems such as insecticide resistance or ineffective interventions.

Routine entomological surveillance operations will be replaced by responsive operations that concentrate on collecting core bionomic data (species presence, biting behavior in villages and in forest/field settings, and resistance status if possible) from outbreak areas, persistent transmission foci and high burden areas in order to identify causes and develop solutions. Where HR capacity permits, entomologists will also monitor the effectiveness and impact of IRS as an outbreak/focus response intervention.

All entomological data will be entered and stored in the entomological surveillance module in DHIS2 and routinely analyzed alongside epidemiological and other programmatic data.

Strategic intervention 2.4: Develop community materials and IEC/BCC activities that target the highest risk populations and health practitioners

Malaria prevention must go hand in hand with community participation. Unless individuals in communities see the merits of preventing the illness, even the best-designed prevention strategies might not be used.

Implementation of IEC/BCC has traditionally been conducted by the IEC unit within CMPE. However, as the program moves towards elimination it will need to gain efficiencies through improved coordination and integration with the national MOH Centre for Information, Education and health (CIEH). The IEC/BCC malaria specific work generated by CMPE will be integrated into the CIEH broader health education packages so that this work becomes sustainable.

While some IEC/BCC materials have been developed to target ethnic minorities, these materials have been developed through a top down approach, without sufficient engagement or background work with the target populations. In future, the program will provide support for elimination of malaria through comprehensive behavior change communication (BCC), community mobilization and advocacy. The program will work with CIEH and implementing partners and communities to educate target groups on malaria and its prevention and support improved access to malaria case management for migrant populations visiting endemic areas; on arrival, during their stay and on their return to their home bases.

Every two years the program will conduct an in-depth independent assessment of BCC methodology and approaches and revise as appropriate.

With the inclusion of the communities and civil society organizations, the program will develop and produce target-group-specific and locally appropriate BCC materials and methodologies for all high-risk groups, as well as for communities approaching elimination. Materials are likely to include interpersonal communication (IPC) aids, audio and video sketches and presentations, billboards, posters, brochures, articles and pamphlets and innovative approaches such as use of mobile application assisted health education. The approach will be tailored to the specific requirements of the target groups and to the specific requirements of elimination. Products will be multilingual wherever appropriate.

Every year a large-scale community mobilization event will be held on World Malaria Day (25 April), an important opportunity for high-level advocacy.

Mass media-based communications will be employed both at national and sub-national levels, taking full advantage of free opportunities where possible. Activities will include public service announcements on television and radio, participation in chat shows, articles in newspapers and use of social media, etc.

Socialization of malaria will be supported by encouraging religious, civil-social and charitable organizations, NGOs and village leaders to be fully involved in malaria elimination.

Strategic objective 3: Ensure effective nation-wide and integrated surveillance system that is elimination capable by 2022

Strategic intervention 3.1: Use of a regularly adjusted stratification approach supporting the implementation of a targeted set of interventions

As Lao PDR progressed towards elimination, finer scale mapping was required, and stratification became more specific, moving from district level stratification to health facility catchment areas. Moving forward, the malaria programs aims for conducting regular stratification exercises in Lao PDR in the next strategic period include:

- To stratify districts into elimination or burden reduction areas every two years using Annual Parasite Incidence (API) data from DHIS2.
- During this exercise, the program will re-stratify or update the Health Facility Catchment Areas (HFCAs) using village level whole case numbers from DHIS2 to help guide intervention planning and implementation. In addition, rapid analysis of the malaria burden at health center catchment level will be conducted annually to ensure that any villages that are within a lower risk HFCA but which have subsequently experienced high case numbers can be re-stratified into a higher risk strata so that core interventions (such as LLINs and appointment of a VMW) can be applied.

Universal coverage of malaria testing and treatment will continue to be provided at all HFCAs (all risk stratum), however the amount of minimum stock maintained to provide these services may need to be adjusted according to the risk of local transmission. Information, education and communication (IEC) materials will also be made universally available at all HFCAs in the country. Catchment areas that are free of malaria or are considered a very low risk will only be provided these two important interventions.

Moderate and high-risk strata will be provided with additional interventions beyond access to quality universal testing and treatment and Information, Education, and Communication (IEC) activities. These interventions will include providing VMWs and LLINs in targeted high burden villages in moderate risk stratum, as well as outbreak (burden reduction areas) and foci (elimination areas) responses. In the highest risk areas, stratum 4, all villages in the catchment area will be allocated with a VMW and will also be eligible to receive a LLIN every 3 years. Case based surveillance and implementation of related elimination response activities (notification, investigation, classification and foci response) will also be applied to all strata if they are within an elimination district (Table 3).

Table 3: Intervention Packages for HFCA Strata

STRATA	Intervention Packages	CASE BASED SURVEILLANCE & RESPONSE Applied as an intervention in all elimination districts
<i>Stratum 1</i> <i>Malaria Free</i>	<ol style="list-style-type: none"> 1. Universal testing & treatment 2. IEC 	
<i>Stratum 2</i> <i>Low risk</i>	<ol style="list-style-type: none"> 1. Universal testing & treatment 2. IEC 	
<i>Stratum 3</i> <i>Moderate risk</i>	<ol style="list-style-type: none"> 1. Universal testing & treatment 2. Universal LLIN coverage 3. Targeted VMWs (villages with at risk populations) 4. Outbreak or Foci response (ACD, IRS, Entomological surveillance, LLIN top up) 5. IEC 	
<i>Stratum 4</i> <i>High risk</i>	<ol style="list-style-type: none"> 1. Universal testing & treatment 2. Universal LLIN coverage 3. Universal VMWs (including FTAT) 4. Outbreak or Foci response (ACD, IRS, Entomological surveillance, LLIN top up) 5. IEC 	

Strategic intervention 3.2: Timely, accurate, and complete reporting and analysis to improve central and sub-national data usage and appropriate response

Lao PDR’s national health information system uses the DHIS2 platform which has been intensively developed and rolled-out over the past five years to help improve national health data collection, reporting and analysis. Most communicable disease programs are now integrated into the DHIS2 HMIS, including malaria which was integrated in 2017. Routine malaria data (passive case detection data) is currently collected on paper forms at all service delivery levels (VMWs, HCs, Hospitals and PPMs) and input electronically into DHIS2 at the district level in all provinces. The PPM data however is entered electronically at point of care and data is then uploaded into the HMIS by Population Services International (PSI), which manages the PPM network in cooperation with CMPE and MOH.

In recent years the malaria module within DHIS2 has been expanded to include PPM data, elimination data (case notification, case investigation, case classification, focus investigation and focus response) as well as iDES, vector control interventions (LLIN distribution, IRS) and entomological surveillance. The PPM data will need to be further integrated as it is currently entered into a parallel DHIS2 PPM database and then automatically ‘pushed’ into the MIS DHIS2 at the end of every month. Direct entry of PPM data into the MIS DHIS2 will improve alignment and data accuracy and eliminate the parallel system. TES data (including historical data) and data relating to mapping of molecular artemisinin and partner drug resistance markers are also likely to be incorporated into the malaria DHIS2 module in the near future.

Use of DHIS2 data to inform decision making has improved significantly since its roll-out, however its use is limited by staff capacity at all levels, especially at district level (insufficient and under-trained human resources). Additional and refresher surveillance training will need to be conducted annually to support more accurate and timely data entry and to strengthen data interpretation and response. In addition, routine data review meeting at all levels will be implemented to monitor data entry, reporting, and epidemiological trends.

There are many infrastructure challenges, including lack of computers, limited internet access and a need for IT support, especially at the sub-provincial levels. The optimal use and functionality of electronic and web-based information systems such as DHIS2 also require routine software and hardware upgrades.

Moving forward, CMPE is aiming to develop and implement strategies for real time reporting. The program will pilot different options for rapid notification (mobile application, SMS-based reporting, etc.) and plan for scale up of the selected option. As part of the roll out, a Device Management Strategy to procure and maintain a repository of mobile devices for real time reporting will be designed and Health Centers and VMWs will be trained.

As the VMWs are a critical cadre for diagnosis and treatment, the program is aiming to strengthen specifically the VMW information system, including integrating reporting for VMWs into DHIS2.

Strategic intervention 3.3. Effective use of a cohesive national malaria surveillance management system that is integrated into public health emergency operations center

Strengthening a public health emergency operations center (PHEOC) will accelerate the Ministry of Health's transition from malaria control to elimination by further transforming surveillance into a core intervention, improving accountability for key malaria metrics, and strengthening an incident management system (IMS) for rapid response. A successful PHEOC model will help unlock additional resources and improve oversight and coordination of the mechanisms required to respond to malaria cases in an elimination setting.

The establishment of the committee for PHEOC decree, signed by the Minister of Health in September 2019 formally established the PHEOC within the Department of Communicable Disease Control (DCDC). As malaria was established as a notifiable disease in 2020 and the malaria surveillance system was the first program to integrate into the national health information, DHIS2, in 2017, it is the pilot for using the PHEOC.

Integration of malaria surveillance, routine monitoring, and response into the PHEOC and leveraging a flexible IMS structure will provide a model that shortens the elimination endgame, will provide a sustainable impact and move the national malaria control program into a more integrated communicable disease prevention and control structure at both the national and sub-national levels.

The program will continue to work with the PHEOC to strengthen analytical capacity of core malaria data at national, province and district level in high burden areas and elimination districts with active foci.

As part of the MOH and DCDC strategy to have more integrated structures and systems (HR, finance, service delivery) around communicable disease control, as well as the ongoing enhancement of the PHEOC, CMPE and the provinces and districts will work to align malaria elimination surveillance and response with these integration plans. This will include incremental changes in staff disease response assignments across the notifiable diseases at the provincial and district level as well as working to improve funding flow mechanisms so that funding can be available within 24 hours for an appropriate and timely response operation.

In addition, the malaria program will ensure that technical sustainability is built within MOH structures and strategies (especially at sub-provincial levels) to maintain an effective national health information system, including additional integrated IT support from central to district level. Computer and internet accessibility will need to be provided to staff inputting data into DHIS2 at all levels.

Strategic intervention 3.4: Implement case notification nation-wide and case and foci investigation, classification, and response in Elimination Districts

The program has been implementing the classical 1-3-7 elimination strategy since adopting case-based response activities in mid-2018. This includes notification of all confirmed cases within 1 day, followed by an investigation and classification³ of the case by a rapid response team (RRT) within 3 days, and a focus investigation for all locally acquired (indigenous or introduced⁴) cases together with focus response if appropriate within 7 days. To date this approach has been difficult to standardize, and case investigations and focus responses have often been delayed. The main causes

³ Cases are classified as indigenous, introduced, imported from another district, imported from another province, imported from another country, induced (from a blood transfusion), recrudescence or as a relapse of *P. vivax* or *P. ovale*.

⁴ Malaria acquired by mosquito transmission from an imported case in an area where malaria is not a regular occurrence.

of these delays relate to access: long travel times for provincial or even district staff to access the remote locations of many cases; and, heightened inaccessibility during the rainy season. Additionally, if a case is classified as locally acquired, the RRT must travel back to their district or province to apply for additional funding to conduct the focus investigation (and response if appropriate). Delays in the funding approval process add to the problems associated with operationalizing the 1-3-7 strategy.

To mitigate these issues the program will develop a contextualized, pragmatic, and dynamic approach to the 1-3-7 strategy, flexible in the last two steps (3 – 7) which takes capacity and geography fully into account. In elimination districts CMPE and partners will train key staff at Health Centre level to conduct case investigations (and case classifications) themselves. This will negate the need for a provincial and district RRT to travel to the village, saving time and money. This essentially means a strategic shift in how the 1-3-7 strategy is applied, where case notification and case investigation (the “1” and “3” component of the strategy) will both be performed at the health facility by health facility staff on the day that the patient is diagnosed. Remote verification of the case classification will be carried-out by the province and/or district over the phone by day 3.

If the case is classified as locally acquired then national (CMPE and PHEOC), provincial and district elimination focal points will be informed immediately via phone, SMS or other communication platform. An RRT will be assembled at district and/or provincial level to conduct a focus investigation and in the event of an active focus being confirmed, a focus response within seven days (the “7” component). The focus investigation will involve reactive case detection (RACD) amongst household members, members of adjacent households and any peers that the patient has overnights with in the previous two weeks. If an active focus of transmission is confirmed, then the RRT will implement a focus response the scale of which will be tailored to local circumstances.

Focus response measures include:

1. Reactive case detection (RACD), screening the population within a 1km radius of the index case (or 500m radius for urban areas) and providing radical treatment for any positive cases according to NMTGs. This radius for screening may be expanded if additional cases are found.
2. Full and separate case investigations for any additional cases of malaria detected during RACD.
3. Mapping of cases and risk populations in the focus area.
4. Evaluating LLIN coverage and utilization and providing supplementary LLINs where required. In case LLINs are not available, or in areas where LLIN coverage is high but utilization is low then IRS will be conducted instead.
5. Establishing community-based malaria case management services where not already available.
6. Conducting pro-active case detection (PACD) annually for two years while a focus is classified as a ‘residual non-active’ foci before it can then be classified as ‘non-active’ if no further locally acquired cases are detected in that time.

In persistent transmission foci CMPE staff will conduct entomological assessments to identify any issues, such as the development of insecticide resistance or changes in vector behavior, that may be undermining malaria control efforts. Where issues are identified alternative approaches will be developed.

Proactive case detection (PACD) will be conducted as part of the routine annual response in residual non-active foci. PACD will screen populations based on symptoms and criteria as per the NMTGs.

The program will revise the current “Malaria elimination surveillance and response guidelines” to reflect the lessons learnt in rolling-out elimination level activities between 2018-2020 and incorporate strategic shifts for the 2021-2025 period. Notification and case and foci investigation training will be conducted for all necessary stakeholders based on the revised guidelines. This includes training of PCDC, provincial and district malaria officers, HCs, VMWs, PPMs, hospital and military on these surveillance protocols. All RRT staff are also to be trained in all notifiable disease responses, including malaria. Additionally, malaria staff will need to be included in DCDC training, along with the Field Epidemiology Training Staff from the National Center for Laboratory and Epidemiology (NCLE), which will help accelerate integration across all communicable diseases.

Strategic intervention 3.5: Accelerating burden reduction to reach elimination: improving early detection and prevention of malaria outbreaks and epidemics

Outbreak preparedness will be maintained and strengthened in burden reduction districts through training, supportive supervision and the provision of equipment and supplies for provincial and district level response teams. A buffer stock of LLINs, will be procured and maintained every three years at central level. These nets will be provided nets to villages that are found during an outbreak or active foci response to either have no nets or low LLIN coverage rates. The outbreak and foci response emergency response buffer will be 2% of the total LLINs procured for mass distribution every three years. The existing levels of buffer stocks of ACTs that are maintained at central, provincial and district level will be sufficient to provide supplies for any outbreak response activities. Stock rotation with routine supplies will be applied to prevent expiry of all buffer stocks.

In addition, the MoH will work with WHO to develop pre-agreed arrangements to obtain ACT from neighboring countries in the event of a full-blown epidemic.

At present, cases from routine monthly passive case detection (PCD) in DHIS2 are used to identify outbreaks in high burden districts. This means that, despite significant improvements in reporting timeliness, there is still an intrinsic delay of roughly 6-weeks in identifying any outbreak due to PCD reporting procedures in these burden reduction districts.

Once an outbreak alert has been issued, additional time is required for a response to be funded and implemented. To improve the timeliness of outbreak detection, VMWs and Health Centre staff will be required to report by phone immediately if higher cases than what the staff in these facilities are used to experiencing in a single day or week. The introduction of weekly SMS-based reporting of case numbers and species by VMWs and Health Centers (which can be automatically pushed into DHIS2) in outbreak prone areas will be piloted to further improve the timeliness of reporting and response.

Each health facility in high burden districts will also be issued with a facility-specific paper wall chart for plotting their weekly malaria caseloads. Weekly outbreak thresholds will be identified once reporting is improved and is on a weekly or real time basis.

Prompt desktop investigations will be carried out in response to any suspected outbreak reports by provincial teams to verify relevant data in DHIS2 and confirm that the outbreak is 'real'. A rapid response team (RRT) composed of staff from the provincial communicable disease control unit (PCDC), malaria district teams and health facility level will then initiate response activities as soon as possible. The response will cover parasitological (active case detection), entomological/vector control (surveillance, LLIN assessment and top up if necessary and targeted IRS) and sociological factors (identifying risk behavior and methods to mitigate the associated risks), and will also include group discussions, interviews and education focusing on risk behavior and treatment compliance. The scale of the ACD will be tailored by the team to fit the local situation (based on the SOPs). Volunteers will assist as necessary. Assessments of clinical and data management skills of the relevant health staff (Health Centre and VMWs) in the outbreak area will also be conducted to ensure quality of care. Refresher training of health care staff and VMWs will be incorporated into this assessment.

Aligned with the overarching Emergency Operating Plan, malaria events will be managed according to the severity/scale of the event and protocols for activating and escalating the PHEOC. Development of precise and flexible thresholds for outbreak notification will be defined by CMPE and DCDC staff as part of the system.

The response team will submit a standardized report to the provincial malaria teams and to the central level (PHEOC and CMPE) within 24 hours of completing their response. The report findings will be entered into DHIS2. RDT-positive cases will receive treatment on the spot, including primaquine, and HC staff/VMWs will conduct follow up of *P. vivax* cases.

Funding flow SOPs for outbreak response will be improved and streamlined, allowing for immediate access to funds for the outbreak response activities, specifically fuel, travel and per diems. A dedicated outbreak response budget line available at provincial level will be included in the NSP costing and associated microplanning.

4.2 Supporting Elements

Supporting element 4: Expand operational research and use of technology to addresses bottlenecks in operations and find innovative ways to address residual malaria transmission and effectively deliver services to hard-to-reach populations

Strategic intervention 4.1: Conduct operational research to optimize impact and cost-effectiveness of existing and new tools, interventions and strategies

To adjust its strategy based on evidence, CMPE in collaboration with partners will be conducting selected operational research to optimize impact and cost-effectiveness of existing and new tools, interventions and strategies. A comprehensive package of needs-based operational research will be supported based on their relevance to the local context.

Current prioritized topics include:

- A number of promising preventative tools are available to tackle the transmission that persists amongst forest-goers. These include long lasting insecticidal hammock nets; topical repellents; and, the treatment of cattle and/or humans with ivermectin as an endectocide. Pilot studies with these promising tools bundled together to address the specific requirements of particular risk groups will start immediately, and on the scale necessary to achieve programmatic impact.
- New tools available for *P. vivax* radical cure (such as quantitative G6PD RDT tests, new medicines, etc.) or detection of infections (high-sensitivity malaria RDTs) will be piloted. This includes application of tools to allow safe administration of primaquine to females.
- Innovative ways of supporting patient compliance with primaquine by HC staff and VMWs will be explored, e.g. supportive personal visits, phone calls to patients, other supervised treatment innovations, etc. In addition, innovative approaches to assist the referral process of *P. vivax* patients from community level (VMW/PPM) to HC/hospital levels for G6PD testing, and for the management of primaquine side effects, will be explored, and also linked to the pharmacovigilance surveillance system.
- Required molecular studies including *P. falciparum* HRP-2 study, Malaria LAMP study, 5-ALA study, and Simian malaria study will be conducted by CMPE in collaboration with national technical partners, such IPL and regional technical partners to monitor the spread of artemisinin resistance in Lao PDR.
- To best respond to cross-border and internal movements, research on malaria-relevant population movements (emphasis on adapting innovative strategies for improved coverage) barriers to access for high risk groups, locally appropriate tools for mobility assessment will be explored.
- To improve quality of IEC/BCC activities and ensure good uptake of core intervention by at-risk population, the malaria program will conduct an anthropological and ethnographic research to better inform effective messaging and communication strategies around health seeking behavior and community mobilization

Strategic intervention 4.2: Conduct annual review of research and take action to facilitate rapid uptake of new tools, interventions and strategies

With technical guidance received from WHO and other partners, CMPE will standardize procedures for the submission, review (including ethical clearance), and routine monitoring of all malaria research projects. Based on each project, findings will be disseminated at the appropriate forums and publication may be pursued, where relevant. Annual technical reviews of research findings will be conducted by the Technical Working Group. Regular meetings between CMPE representatives and research partners will ensure a coordinated national approach.

Research priorities will be reviewed and revised as necessary. Research will only be carried out following approval by the Lao PDR's Ethics Review Committee. The annual review of available and relevant national and regional research findings will be used to inform implementation of the national strategic plan. Where additional clarification or evidence is needed, CMPE and WHO, in consultation with the Research Institute for Education Sciences as well as the National Institute of Public Health, will update operational research priorities for malaria in Lao PDR and disseminate to all partners.

A committee will be established within MoH to place special emphasis on moving proven new interventions and approaches quickly towards operational adoption. An open access research website will be established by technical partners to allow institutions and researchers to access topics of interest, including research proposal submission procedures, ethical regulations, potential funding sources, informal results, publications and a 'Questions & Answers' forum.

CMPE will also work closely with WHO and national and international experts and institutes to develop operational research capacity and improve the quality and relevance of research outputs. They will continue to collaborate with the RSC that is managing a regional package specifically dedicated to operational research and contribute to define GMS operational research priorities. CMPE will also continue collaborating with APMEN on topics related to vivax malaria and entomology.

The program will work in collaboration with WHO, the RSC and national and international experts and institutes to develop research capacity and improve the quality and relevance of research outputs.

Supporting element 5: Strengthen the enabling environment by building sustainable HR, program and financial management capacity, coordination and alignment of partners and greater empowerment at the district level

Strategic intervention 5.1: Strengthen and maintain political commitment and ensure adequate financial support for elimination at national and regional levels.

Advocate for high-level political commitment for malaria elimination:

In 2014, at the 9th East Asia Summit, the Honorable Prime Minister agreed to the target of malaria elimination in Lao PDR by 2030 as part of a regional initiative to achieve a malaria-free Asia-Pacific. This commitment was reinforced at the 10th East Asia Summit in November 2015 when the Asia Pacific Leaders Malaria Alliance (APLMA) Road Map was endorsed by all 18 heads of state in the region. The APLMA Road Map includes the priority actions to be facilitated by the highest level of government including, ensuring national and regional coordination, providing equitable access to quality commodities and services for all populations, improving program efficiency through targeting of certain interventions to achieve maximum impact, mobilizing necessary domestic resources while leveraging external donor support, and supporting innovation for elimination.

In 2017, the MoH of Lao PDR signed the 'WHO Pacific Regional Office' (WPRO) Countries declaration to end malaria by 2030 and in 2018 the 'GMS countries declaration to eliminate malaria by 2030'. This unified approach complements and strengthens the work of international and regional organizations such as WHO, the Global Fund, the Asian Development Bank (ADB) and the World Bank.

To ensure a healthy enabling environment for malaria elimination in Lao PDR, the MOH, CMPE, WHO and partners will continue to lobby for support from the highest levels of government and the private sector.

CMPE will host advocacy meetings for high-level government officers and relevant stakeholders from other health and non-health sectors. Similar advocacy meetings will be hosted at provincial level with local stakeholders.

Lao PDR will assign the existing National Communicable Diseases Control Committee the mandate of overseeing and acting as an 'malaria elimination committee' in order to steer the malaria elimination agenda.

Lao PDR has also launched a Twin city initiative to collaborate at governor's level, so notifiable diseases including malaria are monitored as part of their surveillance component. Starting from 2020, CMPE, provinces and district malaria teams will join the surveillance twin city committees.

Finally, Lao PDR is gradually integrating its malaria response into the broader health system. As described in section 3, malaria has become a notifiable disease and has been elevated to the PHEOC level.

Secure adequate financial resources for malaria elimination and ensure effective utilization of funding:

The National Strategic Plan for Malaria Control and Elimination, 2021-2025 has been costed (See Section 7) and a gap analysis will be completed and updated to understand the ongoing resource needs to ensure effective implementation. CMPE will host an annual meeting with all financial partners (government, multi-lateral financing organizations, bi-lateral donors, foundations) to provide updates on current expenditure of funding, coordinate the use of currently available resources, and mobilize additional funds where necessary. CMPE will work closely with all current and future malaria partners so as to ensure the resources are used in the most efficient manner.

The national program will be mainly financed with external resources by the Global Fund (through the RAI3E), the Bill and Melinda Gates Foundation, USAID, PMI and others. While the domestic resources from the national health budget have increased in recent years, it is anticipated that the Global Fund will remain the largest contributor of malaria in Lao PDR. Although there is a limited fiscal space in Lao PDR, the Government's contribution is aimed to increase and reach US\$ 1,448,208 million by 2023.

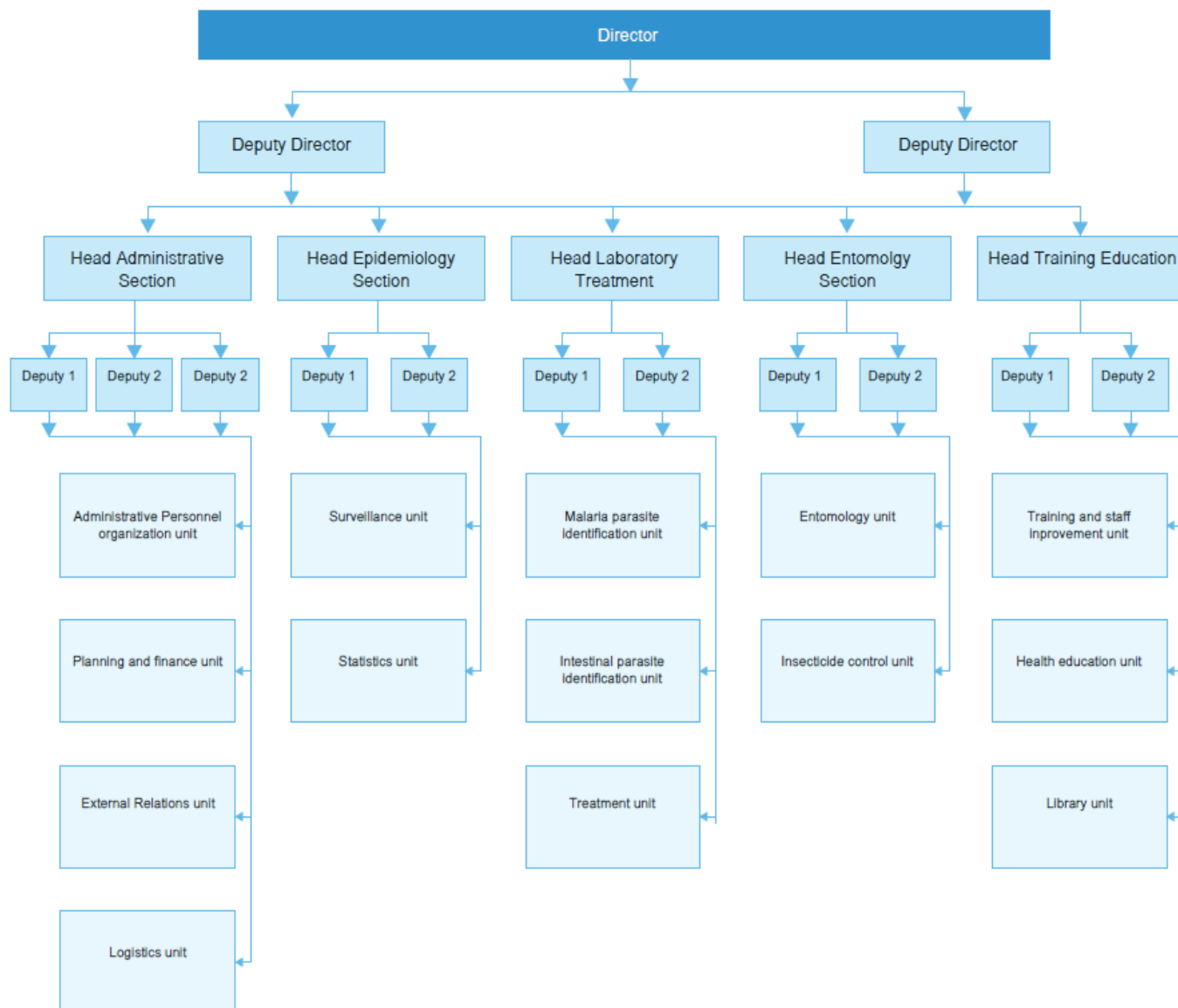
In addition, during the next HSDP phase (2021-25) Lao PDR will explore innovative alternative financing including health insurance coverage, community-based health insurance, blended financing and social impact bonds. Funding flow has been identified as a major challenge, often being the source of delays in implementation. The accounting and finance reporting from provinces to central is done on excel-based software which is an improvement from the previous paper-based system but is prone to accounting mistakes and makes the consolidation from 18 provinces time-consuming and unreliable. To ensure effective use of funds, CMPE will upgrade its accounting system to improve resource tracking and ensure timely disbursement of funds, by shifting to a professional accounting software while simultaneously exploring how to streamline the software usage with other disease areas or MOH's overall strategy at provincial level.

A fund flow assessment will be commissioned to look at streamlining the disbursement processes and identify which intermediary signatures could be avoided in order to speed up the processes. In addition, a formative guidance on financial management and operational manual at province, district and HC levels will be developed. District level financial capacity will be reinforced to enable them to manage fund packages instead of activity by activity budget release. The malaria program is further exploring opportunities to include technological advances such as mobile banking.

Strategic Intervention 5.2: Support capacity development at national and sub-national appropriate to the implementing strategy, strengthening program management and monitoring and evaluation.

At the central level, CMPE has an effective team of malaria staff delivering the malaria program. Under the leadership of the Director and two Deputy Directors, the four technical units (Epidemiology, Vector Control, Laboratory and Treatment, and Training and Health Education) and one administrative unit will remain.

The CMPE reports to the DCDC of the MoH. It provides technical and managerial support for malaria elimination activities. The malaria staff in the provinces and districts report directly to the DCDC at each level (provincial and district). The DCDC plays an oversight role for the malaria program at the macro level, including providing advocacy to higher level authorities within government, fund raising, policy formulation, coordination with relevant ministries and departments, and convening high level meetings including with donors (Fig.5).



However, and as CMPE has no direct authority over the 18 provinces, it is conscious that one of the primary challenges faced while the disease burden reduces, will be to maintain appropriate trained human resources at sub-national level. CMPE will develop a Human Resources plan detailing what package of activities need to remain in elimination settings, and what specific expertise must remain in place during the continuum towards achieving the elimination goal. This exercise will include a phased approach and take into account staff needs at all levels (central, provincial, district and community). CMPE will advocate for MOH to endorse this plan to ensure the availability of trained malaria staff in elimination settings. In addition, CMPE will propose a mechanism for hiring staff on a short-term, grant-funded basis.

In order to strengthen the capacity of the staff, CMPE will be conducting program management and planning. However, despite the occurrence of annual and bi-annual planning and review meetings at the provincial level, structured and systematic meetings remain challenging. With the fact that the program has also been integrated within the DCDC at the provincial and district levels, the role and responsibilities within these new reporting lines will be given special attention. In addition, given the other competitive priorities, malaria teams suffer from high workload resulting in national staff being pulled into multiple partners activities (often in a reactive mode). This can affect time to focus exclusively on their routine malaria activities. To mitigate this risk, a bottom-up planning approach for provincial and district level will be developed and applied.

A comprehensive review of the provincial and district work plans will be conducted regularly, including review of all partner activities, in order to support timely implementation of critical malaria elimination activities as part of the

subnational plan. Routine informal monthly operational program meetings will be implemented in all provinces to review elimination data as well as to follow-up action points from previous meetings. Finally, CMPE will provide technical guidance for malaria control and elimination to staff at all levels.

To build an accountability and feedback loop, CMPE will conduct Annual Review and Planning Meeting with PAMS to review progress to date, challenges, and future plans. Similar meetings will take place at lower level, quarterly between PAM and AMNs, monthly between DAMNs and HCs, and HC and VMWs. A Surveillance Monitoring and Evaluation (SME) plan, in line with the 2021-2025 NSP and gap analysis, will be developed and disseminated at all levels, for routine review of the key indicators and targets.

Finally, the malaria program will be conducting a mid-term and end-term malaria program review to assess achievements, progress to date, and areas of improvement to inform the next national strategic plan.

Strategic intervention 5.3: Strengthen health systems to facilitate the implementation of an integrated elimination strategy

Integrate malaria program within the larger CDC umbrella

In 2019, the Provincial Anti-Malaria Station (PAMS) and District Anti-Malaria Nuclei (DAMN) were dismantled and replaced by provincial and district malaria teams. CMPE will keep its direct programmatic responsibility for malaria and other vector-borne and parasitic diseases at sub-national levels. It will continue providing the provinces with funds, key commodities, technical advice and support. As malaria expertise remains with Provincial and district technical officers, CMPE will continue to advocate that malaria remains on the map in elimination settings and that dedicated staff are allocated towards malaria interventions in high burden districts. CMPE will further attend workshop with MOH/DCDC and help shape that integration of the staff and the timelines, along with provide support to build capacity of DCDC and PHEOC staff on how to monitor and respond to malaria events.

Maintain administration and human resources setup

CMPE needs to procure office utility items; vehicles for administration, conduct training and supervision activities; and maintain human resources at all levels including salaries to ensure smooth operations for implementing each of the strategies.

Strategic intervention 5.4 Leverage streamlined logistics data and develop ongoing coordination with MPSC and partners to strengthen supply management and ensure continuous supply of malaria commodities for all interventions

Despite progress toward improved stock management in recent years, significant supply management issues continue to result in stock availability challenges at all levels of the healthcare system. PSM gaps include parallel stock flow outside of the national integrated stock management system, duplicative data reporting systems, and limited capacity of staff across the health system to effectively forecast supply need and allocate resources to facilities at lower levels.

To mitigate these challenges, CMPE, together with relevant MOH departments including MPSC, FDD, UNOPS and technical partners, will work to improve coordination and align current stock management practices with the integrated national supply chain for all programs. As Lao PDR progresses toward malaria elimination, CMPE will reduce costs and improve efficiency by handing over routine warehousing and distribution responsibilities to MPSC. This will reduce the need for separate distributions of malaria products, which require additional funds and transportation. The national integration of stock management will also allow CMPE to focus on forecasting and supply planning, and to have an oversight role of malaria stock commodities, rather than day-to-day implementation. This will require close collaboration with MPSC to provide ongoing support to provincial, district, and health facility staff for accurate data reporting and improved stock management.

CMPE will leverage data from the national eLMIS to inform decision-making at all stages of the supply cycle, including quantifications and allocations. Staff at provincial, district, and health center levels will review stock and programmatic data

on a monthly basis, in order to regularly monitor stock levels in facilities and ensure continuous supply for programmatic activities. In-line with the national health systems strengthening strategy, MoH will implement the national roll-out of the networked eLMIS/mSupply. This system is used to manage commodities stored in and distributed from FDU warehouses by MPSC and has made available real-time stock on hand data by batch. Stock data will then be visualized in the HMIS DHIS2, along with epidemiological data, improving access and use for staff at all levels.

To ensure national supply availability, CMPE will include stock data review in the monthly programmatic meeting. This will improve alignment with any programmatic changes that affect stock consumption. In addition to the annual forecast, CMPE will conduct quarterly supply planning meetings with MPSC and partners, to review the annual quantification and current testing trends, and to revise the supply plan as necessary to ensure appropriate national stock levels and prevent stock outs. CMPE will also ensure that all technical partners at central level work closely with program staff to include systematic skills transfer in every supply management activity. CMPE with technical assistance will continue developing the supply management capacity of staff at all levels through targeted supervision visits and trainings on data use and supply planning best practices. These trainings will focus on ability to forecast supply need and implement changes as described in the updated national stock management policies, using the updated LMIS stock management policy.

Strategic intervention 5.5: Develop a comprehensive service delivery strategy at the community level to meet the needs of all at risk populations, including mobile populations and migrants

Malaria control and elimination in Lao PDR has embraced a comprehensive service delivery model. In addition to the malaria services provided in public facilities, the program works closely with a network of community-based healthcare providers through village malaria workers (VMW).

By expanding access to early diagnosis and treatment in remote or hard-to-reach malaria-endemic areas, VMWs supported externally and Village Health Volunteers (VHVs) will remain a central part of the Lao PDR National Strategic Plan 2021-2025. The foundations and processes of the VMW program are strong and CMPE will ensure that the VMWs remain well-regarded by the community, commonly serving in multiple health roles. They will continue to receive supervision, commodities and remuneration. CMPE will update regularly all protocols and standard operating procedures to guide the VMWs and work with partners to implement the VMW program. VMWs will be trained on an on-going basis to provide malaria diagnosis, treatment, health education and to report.

CMPE will develop and refine a well-understood, and well-disseminated VMW strategy, including VMW operational guidelines and terms of reference as well as VMW allocation and a stronger coordination mechanism. Coordination at all levels (central, Provinces, Districts, HCs, partners and VMWs) will be reinforced including refresher training based on requirements along the continuum towards elimination.

In addition, CMPE will reinforce VMW reporting mechanisms and integrate parallel information systems into DHIS2 where possible. VMW management at the HC level will as well be reinforced through optimizing monthly meetings, and formally recognizing HCs as supervisors and equipping HCs staff with the tools and training to mentor and supervise VMWs. This will be in addition to the management role provided by the government and CSOs.

Together with the DCDC, CMPE will develop a medium- and long-term strategy to integrate VMW into a broader multi-tasked village health worker as an extension of the national primary health service delivery system. While discussions should happen beyond CMPE, it is the programs role to ensure malaria case-based surveillance is maintained in elimination areas. Indeed, as the country shifts to elimination settings, and in order to sustain the services provided by the front line VMWs, the workers will either be integrated into the overall health service delivery scheme to provide other health services to the population (iCCM/ Essential Package of Services -EHSP) or be replaced by VHVs. CMPE will develop a phasing strategy to shift VMWs to VHVs in-line with its stratification approach.

The two following activities are envisioned:

In burden reduction areas: VMWs maintained with an expansion of their tasks. In this scenario, VMWs will provide an extended package of services in addition to malaria. CMPE will work closely with other programs (HIV, TB, MNCH) to look at cost-efficient approaches to make the best use of the respective networks. CMPE will explore the possibility to link the network of VMWs with the incentive-based mechanism.

In low burden and elimination areas: VMWs will be replaced by Village Health Volunteers (VHV). In this scenario, the VHVs will take over the malaria community role and provide malaria health education and refer suspected malaria cases to HCs and provide follow-up. A new national policy on village-based community health workers will be developed, and CMPE will work closely with DHC/MoH to ensure the required malaria package of activities remain integrated in the national community service delivery approach.

Strategic intervention 5.7: Foster leadership, partnerships, inter-sectoral collaboration, community involvement, cross-border collaboration and collective action for malaria elimination

Extend and strengthen leadership, functional partnership and coordination

CMPE will work to continue broadening its partnerships for malaria with other centres and units within the MoH, other departments of government, the private sector, non-governmental organizations, multilateral agencies, financial partners, media, and community organizations, to achieve the objectives of this strategy.

As mentioned in intervention 5.1, MoH will assign the National Communicable Diseases Control Committee, that is chaired by the Honorable Prime Minister of Lao PDR, the mandate to act as a high-level malaria elimination steering committee in order to oversee implementation and monitor the progress of the malaria control and elimination efforts in the country. This committee will provide the leadership, coordination, oversight, policy recommendations and advice on malaria control, elimination and certification activities across the different sectors. This will ensure that malaria elimination efforts obtain the required impetus from the highest level in the Government.

Provincial and district teams will help establish Provincial Malaria Elimination Committees, nested within the existing Provincial and District Communicable Disease Control Committees, which will include provincial government leadership, key health staff, community partners, and other essential stakeholders, to meet semi-annually to discuss progress in implementation and adapt interventions to their respective local contexts.

To improve coordination, CMPE will continue to oversee and manage the work streams of all the partners working in malaria in Lao PDR. CMPE will utilise a work plan template for all partners and request that partner work plans be submitted to CMPE on a regular basis for alignment with national operational plans for malaria. The CMPE will be responsible for incorporating partners' annual plans into the national and provincial operational plans. CMPE/PCDC and its partners will participate in the monthly meetings of the revitalized Malaria Technical Working Group and discuss and advise on key policy decisions and approaches for successful control and elimination. Additionally, CMPE will host a quarterly partner coordination meeting as a forum for general updates on workplan progress and challenges. CMPE will continue to work closely with the army especially in remote areas.

Regional collaboration to strengthened cross border effective response

In line with the WHO's *Strategy for Malaria Elimination in Greater Mekong Subregion (2015-2030)*, the MoH and CMPE will seek broader information sharing agreements with national malaria programs and provincial and district health departments in neighboring countries to improve understanding of transmission and population dynamics in the region.

As a member of the Regional Steering Committee (RSC) of the Regional Artemisinin Initiative (RAI), CMPE will participate actively in semi-annual meetings together with a large set of partners including malaria programs in Cambodia, Myanmar, Thailand, and Vietnam, CSO, academics and private sector entities. This provides the opportunity to synchronize the implementation of border-related activities with neighboring countries, share regional data and set a joint operational

research agenda (see supporting element 5). Under the RAI, Lao PDR will place special emphasis in partnering with CSOs specifically on extending access to malaria services among migrant, mobile, ethnic and vulnerable populations.

CMPE will also work together to establish twin-city collaborations with neighboring countries' border districts to establish regular planning meetings as well as joint monitoring and supervision visits with neighboring country health officials.

CMPE will also collaborate closely with WHO's Mekong Malaria Elimination (MME) group, especially on the Regional Data sharing platform (RDSP). In this regard, together with other GMS countries, CMPE will collect and report monthly surveillance data to a regional web-based platform, the RDSP, through the DHIS2.

To expand partnerships and coordination outside of Lao PDR, CMPE will actively participate in regional partnerships and networks. This will include the Asia Pacific Malaria Elimination Network (APMEN), Asia Pacific Leaders Malaria Alliance (APLMA) forums, ACT Malaria and the WHO's WPRO.

Finally, CMPE will participate in the ADB supported Mekong Basin Disease Surveillance initiative.

Develop collaboration with the Ministry of Defense

It is recognized that the Ministry of Defense (MoD) personnel form a significant risk population. WHO estimates that army personnel account for over 10% of confirmed malaria cases reported from the southern provinces. Based on a clear forecast, each patrol will be supplied with LLIN, RDTs and ACT. Army representatives estimate that they require approximately 50,000 LLINs every three years to maintain full coverage. CMPE will develop a curriculum to build the capacity of selected military staff for program management, case management, reporting and coordination with the national program at national as well as sub-national levels. The malaria program advocates for a systematic and direct reporting of military malaria data into the DHIS2. Finally, CMPE will explore possibilities for the use of promising new vector control tools such as topical repellent, etc. by the military.

5. MONITORING AND EVALUATION STRATEGIC FRAMEWORK

5.1 Strengthening M&E in line with the national strategy

Collecting useful and complete data in a timely manner will help CMPE to effectively monitor and evaluate trends in malaria epidemiology, the impact of interventions, and improvements in program management to guide implementation of the national strategic plan. The core Surveillance, Monitoring and Evaluation responsibility for the National Malaria Program will be with the Epidemiology section of CMPE. The current Monitoring and Evaluation Plan will be updated to align with the National Strategic Plan for Malaria Control and Elimination, 2021-2025. CMPE with support of technical partners will train all malaria-relevant staff on the national Monitoring and Evaluation Plan and provide refresher trainings annually; malaria Monitoring & Evaluation training will be incorporated into other health staff training where possible. All data for monitoring and evaluation will be compiled in CMPE's malaria information system and cross-analyzed to improve program performance. Since introduction of DHIS2, M&E capacity is significantly improved. A larger set of data can now be analyzed monthly.

In addition, as malaria has been the lead in implementing electronic data systems in Lao PDR, and the malaria program is on track to achieve its malaria elimination goals, it will be one of the first diseases to integrate their program specific surveillance and response protocols into a PHEOC Emergency Reporting Plan (ERP). As part of the strengthening of the PHEOC there will be ERPs developed for all notifiable diseases in Lao PDR. These ERPs will clearly outline the linkages, roles and responsibilities of the PHEOC, the national programs and the subnational levels for monitoring and responding to public health threats and emergencies (including malaria). The format of the malaria ERP will form the basis of the ERPs for other diseases.

To evaluate overall progress toward national strategy goals, a Mid-Term Review of the NSP will be carried out by CMPE and WHO in 2023 to track progress against outlined indicators. A Malaria Program Review will follow in 2025, providing a thorough review of national malaria progress to inform the development of the next five-year national strategic plan.

Finally, as part of the RAI, Lao PDR will benefit from the Independent Monitoring Panel (IMP) reviews and recommendations to guide and adjust their strategy as needed.

5.2 Strategic M&E framework

Goal/Objectives	Indicator name	2021	2022	2023	2024	2025
Impact / Outcome indicators						
To eliminate Plasmodium Falciparum malaria in the entire country and eliminate all species of malaria in the 13 northern provinces	API (Number of confirmed malaria cases per 1,000 mid-year population per year)	0.55	0.41	0.30	0.22	0.16
	Annual inpatient malaria deaths	0	0	0	0	0
	Annual Blood Examination Rate: number of parasitological tests carried out per 100 persons per year. (total country's population as denominator)	9.5	10	10	10	10
	Annual Blood Examination Rate: number of parasitological tests carried out per 100 persons per year. (Elimination area: population as denominator)	3.19	3.30	3.26	3.21	3.17
	Annual Blood Examination Rate: number of parasitological tests carried out per 100 persons per year. (Burden reduction area: population as denominator)	26.73	27.68	27.29	26.92	26.55
	Percentage of malaria cases by species among total parasitological confirmed cases: P.falciparum %	23%	18%	13%	8%	3.3%
	Percentage of malaria cases by species among total parasitological confirmed cases: P.vivax %	76%	81%	86%	91%	96%
	Percentage of malaria cases by species among total parasitological confirmed cases: Mixed%	1%	1%	1%	1%	1%

Goal/Objectives	Indicator name	2021	2022	2023	2024	2025
Output indicators						
Strengthening the enabling environment	Stock-out Rate (RDT/ACT): Percentage of health facilities with no stockout of RDTs/ACT (6x4) of any duration the last month	>98%	>98%	>98%	>98%	>98%
Ensure universal access to quality malaria diagnosis and effective treatment	Percentage of confirmed malaria cases that received first-line antimalarial treatment according to national policy at public sector health facilities.	100%	100%	100%	100%	100%
	Percentage of confirmed malaria cases that received first-line antimalarial treatment according to national policy at communities.	100%	100%	100%	100%	100%
	Percentage of confirmed malaria cases that received first-line antimalarial treatment according to national policy at private sectors.	100%	100%	100%	100%	100%
	Percentage of confirmed P.vivax cases provided with primaquine radical cure	50%	58%	66%	74%	82%
Ensure effective and evidence based preventative measures are delivered to targeted high-risk populations, and that appropriate communication and education on these interventions are provided.	Proportion of population at risk potentially covered by LLINs distributed (WHO indicator)		100%			100%
Nation wide effective and integrated surveillance system that is elimination capable.	Percentage of HMIS or other routine reporting units submitting timely reports according to national guidelines	>95%	>95%	>95%	>95%	>95%
	Percentage of confirmed cases (all species) fully investigated and classified within 3 days in districts with API <1 (including case investigation form).	70%	75%	80%	85%	90%
	Percentage of confirmed P.falciparum cases fully investigated and classified within 3 days in districts with API <1 (including case investigation form).	85%	90%	95%	100%	100%
	Percentage of confirmed active foci (in districts with API <1) investigated in which an appropriate response was initiated within 7 days.	70%	75%	80%	85%	90%

6. FINANCIAL PLAN AND BUDGET

6.1 Costing Methodology

The costing for the National Strategic Plan (2021-2025) was performed using an activity-based costing approach to provide a robust estimate of the resources required to achieve elimination. The methodology identified resources down to the sub-activity level. Quantities, frequencies and durations required were determined of each resource for each activity on a quarterly basis over the next five years. Unit costs for commodities, travel, and human resources were standardized throughout the activities and were sourced from the most recent historical expenditure and active Global Fund grant budgets and guidelines. Trainings, meetings and supervision visits were optimized for budget and feasibility through discussions with each CMPE unit. Inflation was factored in for the duration of the five years.

6.2 Estimated budget

The estimated cost of the NSP over the next five years (2016-2020) is approximately \$44,800,000. The largest cost element is Enabling Environment (Objective 5), which accounts for an estimated 59% (\$26.2M) of the budget. The highest spend activities within this objective are:

- Maintenance of administrative and HR setup (\$13.3M) which includes procurement of office utility items and vehicles for admin, training and supervision activities, salaries of CMPE staff at all levels, and CSO HR and overhead costs at all levels;
- Contribute funds to UNOPS, WHO and PMU for technical and operational support (\$6.2M);
- Maintain admin and HR setup for CMPE-RAI team for operational support (\$1.3M);
- Contribute funds to DPC and MPSC for the RSSH cross cutting component (\$0.9M)

The second largest estimated cost is for Case Management (Objective 1), which accounts for 20% (\$8.9M) of the total budget. The 3 highest spend activities are:

- Forecast and procure commodities for the diagnosis and treatment of malaria (\$2.9M);
- Train village malaria workers on diagnosis and treatment, health education, and reporting (\$2.1M);
- Train all healthcare providers on rapid diagnostic testing (\$1.0M)

The third largest estimated cost is for Prevention (Objective 2), at \$7.1M over the five-year period (16% of total budget). Majority of the costs for Objective 2 are focused on procurement and distribution of LLINs for mass and continuous distribution, which account for \$4.6M and \$1.5M respectively.

The two remaining objectives, Surveillance (\$1.7M, 4%) and Operational Research (\$0.8M, 2%), account for the remainder of the budget. The total estimated budget by objective is depicted below.

Figure 6: Summary of NSP Costing

	2021	2022	2023	2024	2025	Total	% budget by objective
Objective	\$10,387,134	\$9,195,036	\$7,125,790	\$8,760,750	\$9,290,789	\$44,759,499	100%
Case Management	\$2,173,709	\$1,463,229	\$1,848,412	\$1,535,700	\$1,837,416	\$8,858,466	20%
Prevention	\$485,047	\$2,800,635	\$498,101	\$459,956	\$2,857,095	\$7,100,834	16%
Surveillance	\$583,361	\$240,010	\$328,007	\$231,665	\$328,167	\$1,711,210	4%
Operational Research	\$490,638	\$78,284	\$78,375	\$123,051	\$78,375	\$848,723	2%
Enabling Environment	\$6,654,378	\$4,612,879	\$4,372,895	\$6,410,377	\$4,189,736	\$26,240,266	59%
% budget per annum	23%	21%	16%	20%	21%	100%	-

6.3 Resource Mobilization

Financial Partners Mapping

The key sources of funds to the National Strategic Plan (2021-2025) over 2021-2023 include: the Government of Lao PDR, The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) – Regional Artemisinin Initiative 3 Elimination (RAI3E) grant, United States Agency for International Development (USAID) and the President’s Malaria Initiative (PMI), the Asian Development Bank (ADB), and the Bill and Melinda Gates Foundation (BMGF). A preliminary funding gap analysis has been conducted and will be updated as existing resources are aligned with the NSP and new resources are allocated for implementation of the NSP.

Resource Mobilization

To successfully implement the planned activities of the NSP (2021-2025), the MOH and CMPE will continue to develop relationships with current financial partners, while exploring other potential sources and financing mechanisms from the private sector and other donors, as described under Strategy 5.1. Under the same strategy, CMPE also plans to enhance collaboration with the Ministry of Finance and Parliament to explore ways to obtain adequate domestic resources towards civil servant salaries, infrastructures, etc. The DCDC and CMPE plan to emphasize the importance of ensuring transparency, accountability, and efficiency in resource disbursement to ensure effective collaboration with the government and financial partners.



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