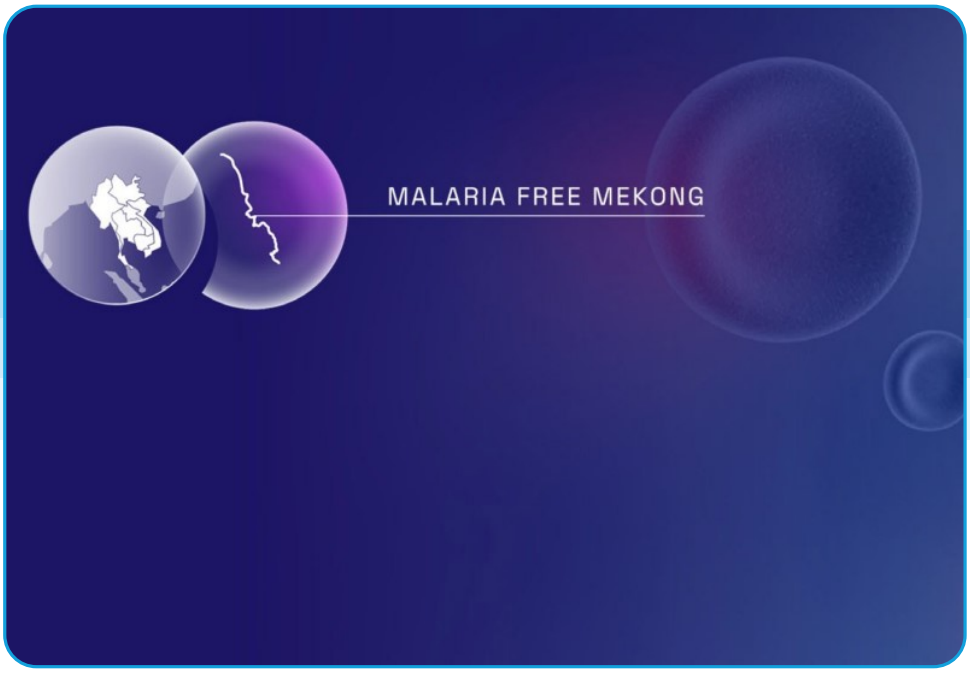
Meeting Report

WORKSHOP ON MALARIA SURVEILLANCE AND MALARIA ELIMINATION IN THE GREATER MEKONG SUBREGION



15–17 November 2023
Siem Reap, Cambodia

World Health Organization
Western Pacific Region

Workshop on Malaria Surveillance and Malaria Elimination in the Greater Mekong Subregion

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WORLD HEALTH ORGANIZATION MEKONG

MALARIAELIMINATION PROGRAMME

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Convened by:

WORLD HEALTH ORGANIZATION
MEKONG MALARIA ELIMINATION PROGRAMME

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NOTE

The views expressed in this report are those of the participants of the Workshop on Malaria Surveillance and Malaria Elimination in the Greater Mekong Subregion and do not necessarily reflect the policies of the conveners.

This report has been prepared by the World Health Organization Mekong Malaria Elimination programme for Member States in the Region and for those who participated in the Workshop on Malaria Surveillance and Malaria Elimination in the Greater Mekong Subregion from 15 to 17 November 2023.

CONTENTS

Keywords:
Health impact assessment / Malaria / Mekong Valley/ Public health surveillance

ABBREVIATIONS

ACT	artemisinin-based combination therapy
AL	artemether-lumefantrine
AS-MQ	artesunate-mefloquine
AS-PY	artesunate-pyronaridine
BCC	behaviour change communication
CSO	civil society organization
CQ	chloroquine
DHA-PPQ	dihydroartemisinin-piperaquine
DHIS2	district health information software 2
G6PD	glucose-6-phosphate dehydrogenase
GMS	Greater Mekong Subregion
ICMV	integrated community malaria volunteers
iDES	integrated drug efficacy surveillance
IPTf	intermittent preventive treatment for forest goers
IRS	indoor residual spraying
LAMP	loop-mediated isothermal amplification
LLIN	long-lasting insecticide-treated bed nets
MDA	mass drug administration
MEDB	Malaria Elimination Database
MME	Mekong Malaria Elimination
MQ	mefloquine
PCR	polymerase chain reaction
*Pf*K13	*Plasmodium falciparum* Kelch 13
PoR	prevention of re-establishment
PPQ	piperaquine
PQ	primaquine
RDT	rapid diagnostic test
SNV	subnational verification
TDA	targeted drug administration
TES	therapeutic efficacy studies
TQ	tafenoquine
WHO	World Health Organization

SUMMARY

The World Health Organization (WHO) Mekong Malaria Elimination (MME) programme hosted the Workshop on Malaria Surveillance and Malaria Elimination in the Greater Mekong Subregion (GMS). This three-day meeting, conducted from 15 to 17 November 2023 in Siem Reap, Cambodia, brought together representatives from national malaria programmes and focal points from five GMS countries – Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam – as well as technical experts and partners. The meeting provided a forum to review the status of malaria surveillance, consider the progress made towards malaria elimination and discuss planning for 2024.

Continued progress towards malaria elimination in Cambodia, the Lao People's Democratic Republic and Viet Nam was acknowledged. However, challenges remain, including malaria in mobile, migrant and vulnerable populations residing in remote areas and cross-border malaria. The Myanmar–Thailand border presents a critical situation. Limited access to populations at risk within Myanmar poses a significant threat to the overall goal of malaria elimination in the GMS. Urgent action is imperative to prevent the outbreak from spreading further into Thailand and potentially other regions.

The Malaria Elimination Database continues to support malarial elimination in the GMS, with plans for a mobile app, automated data acquisition and enhanced data granularity. The Lao People's Democratic Republic and Viet Nam conducted assessments of their malaria surveillance systems, revealing valuable insights into areas requiring strengthening for elimination, such as the need for improved follow-up rates for index cases.

Drugs used for the first-line treatment of malaria in the GMS remain effective, and molecular markers of drug resistance are consistent with observed clinical efficacy. The need for adherence to therapeutic efficacy study protocols was emphasized, and the minimum requirements for integrated drug efficacy surveillance to generate valid, actionable data were discussed. In particular, the need to follow up all malaria cases was stressed. An increase in the prevalence of *Plasmodium malariae* cases, especially in Viet Nam, was identified, signalling the need for further investigation.

P. vivax causes severe disease and death and is the most common cause of malaria in the GMS. The need for effective and safe deployment of radical cure interventions was emphasized. Point-of-care quantitative glucose-6-phosphate dehydrogenase (G6PD) testing is being piloted and rolled out in several countries. In Thailand, following encouraging data from the ARCTIC study, plans are underway to deploy G6PD quantitative testing and tafenoquine to six provinces with a high burden of malaria. Where radical cure cannot be safely deployed, mass drug administration with at least four rounds of chloroquine is an alternative approach.

Cambodia, the Lao People's Democratic Republic, Thailand and Viet Nam continue to strengthen case identification, investigation and foci response, and subnational verification is in progress to support future national malaria-free certification. WHO is developing guidance for prevention of re-establishment (PoR) of malaria, addressing risk factors like malaria receptivity and importation potential. Integration of malaria services into the general health system to ensure sustainability is an essential component of PoR planning going forward.

In conclusion, Cambodia, the Lao People's Democratic Republic and Viet Nam are approaching *P. falciparum* elimination, but the situation in Myanmar threatens to undo progress in Thailand and across the GMS. Current first-line drugs against *P. falciparum* and *P. vivax* are working effectively. However, new approaches are required to address *P. vivax* malaria, including the deployment of radical cure. PoR planning is a key additional activity for 2024, and WHO continues to provide technical support to the countries to support malaria elimination activities.

1. INTRODUCTION

1.1 Meeting organization

In 2018, ministers of health from the six Greater Mekong Subregion (GMS) countries – Cambodia, China (Yunnan Province), the Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam – adopted the World Health Organization (WHO) *Strategy for Malaria Elimination in the Greater Mekong Subregion (2015−2030)*. The strategy aims to eliminate *Plasmodium falciparum* malaria by 2023 and all forms of malaria by 2030 from the GMS.

WHO actively supports the implementation of this strategy through various entities, including six GMS country offices, two regional offices (South-East Asia and Western Pacific), the subregional team of the Mekong Malaria Elimination (MME) programme, and the Global Malaria Programme at WHO headquarters.

The WHO MME programme hosted the Workshop on Malaria Surveillance and Malaria Elimination in the GMS. This three-day meeting, conducted in Siem Reap, Cambodia, brought together representatives from national malaria control programmes and focal points from five GMS countries (Cambodia, Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam) as well as technical experts and partners.

The meeting provided a forum to review progress in reducing malaria morbidity and mortality, the status of elimination and surveillance systems, updates on therapeutic efficacy studies (TES) and integrated drug efficacy surveillance (iDES), the challenges for the elimination of *P. vivax* and potential strategies to accelerate progress towards this goal, and the status and progress of subnational verification (SNV) of malaria-free status and prevention of re-establishment (PoR) of transmission.

1.2 Meeting objectives

The overall objective of the meeting was to assess progress and preparedness towards malaria elimination, including *P. vivax*, and review the available results from the ongoing TES and iDES.

The specific objectives of the meeting were:

(1) to strengthen malaria surveillance systems in GMS countries, including cross-border surveillance;
(2) to review antimalarial drug efficacy and resistance data in the GMS countries and discuss policy changes if necessary;
(3) to prepare GMS countries for WHO certification of malaria elimination, including SNV and PoR; and
(4) to discuss the challenges of *P. vivax* malaria elimination and innovative strategies.

The list of meeting participants is provided in Annex 1, and the meeting programme is in the Annex 2.

2. PROCEEDINGS

2.1 Opening session

Dr Pascal Ringwald, WHO MME programme, delivered the welcome address, expressing gratitude to the participants for their commitment to malaria elimination in the GMS. He then presented the meeting objectives and nominated Dr Chea Huch (National Centre for Parasitology, Entomology and Malaria Control, Cambodia) as chair for day 1 and Dr Tint Naing (Kachin State Department of Public Health, Myanmar) as co-chair. Dr Huch accepted the nomination and opened the conference.

2.2 Status of malaria surveillance

2.2.1 Country updates

Cambodia
Dr Siv Sovannaroth from the National Center for Parasitology, Entomology and Malaria Control highlighted the decreasing malaria case burden in the country, concentrated along borders with Viet Nam and the Lao People's Democratic Republic. Most cases (97%) are *P. vivax*, and primaquine (PQ) radical cure is deployed for glucose-6-phosphate dehydrogenase (G6PD)-normal cases only. The surveillance system employs active case detection, reactive case detection, real-time case notification and foci investigation (1-3-7 strategy), achieving high completion rates (>90%). Active foci receive targeted drug administration (TDA), intermittent preventive treatment for forest goers (IPTf) and active fever screening. Quality control involves external competency assessment for malaria microscopists, national competency assessment and subnational capacity-building.

Challenges include addressing mobile, migrant and vulnerable populations; communication on personal protection; sleeping behaviour inconsistent with effective protection from long-lasting insecticide-treated bed nets (LLINs); and the absence of *P. vivax* radical cure for G6PD-deficient patients. In areas with a low malaria burden, prioritization becomes challenging, necessitating cross-cutting integration approaches. Despite these challenges, Cambodia is making progress toward malaria elimination, driven by commitment at all levels and effective collaboration with partners, donors and community networks.

Key discussion points were as follows:

- Radical cure is switching from14-day to seven-day PQ treatment. While neither is administered as directly observed therapy, community worker follow-up with patients and adherence are considered adequate.
- Tafenoquine (TQ) has not been implemented.
- G6PD prevalence is around 20% in Cambodia.

Lao People's Democratic Republic
Dr Phoutnalong Vilay from the Center of Malaria, Parasitology and Entomology reported a significant (68%) reduction in malaria cases following the implementation of accelerator strategies in 2022. In 2023, most cases (90%) were *P. vivax*, with *P. falciparum* transmission concentrated in small pockets within remote ethnic minority communities where risk behaviours, such as sleeping in fields or forests and land clearance, perpetuate transmission. Surveillance guidelines for burden reduction areas were revised in mid-2023, emphasizing elimination through real-time reporting, case investigation and outbreak response (1-3-7 strategy), with TDA if outbreaks persist for more than a month. The management of commodity stock levels is facilitated by mHealth and District Health Information Software 2 (DHIS2), which is accessible to all users through dashboards, with a district-level quality check system currently undergoing a pilot phase. Malaria risk stratification will be updated in the first quarter of 2024.

In response to a *P. vivax* outbreak in the previously malaria-free Nakai district in Khammoune province, aggressive interventions, including active case detection, entomological surveillance, radical cure with PQ, LLIN distribution, indoor residual spraying (IRS), behaviour change communication (BCC) and

TDA with artesunate-pyronaridine (AS-PY) were implemented. While cases have significantly decreased, ongoing transmission prompted a seroprevalence survey to investigate transmission drivers, and PvSeroTAT is being used to direct *P. vivax* radical cure. The outbreak remains under investigation and underscores the importance of robust surveillance systems after achieving elimination.

Key discussion points were as follows:

- Refresher training for health facility staff is done annually after a health district is designated malaria-free.
- Village health workers need to be recruited from the community.
- Advocacy with district, village and community leaders is key to achieving high TDA follow-up rates.

Thailand

Ms Suravadee Kitchakarn from the Division of Vector Borne Diseases of the Ministry of Public Health highlighted the primary challenge of refugee migration from Myanmar. Since 2021, there has been a substantial increase in malaria cases, particularly in the six provinces along the Thai–Myanmar border, with *P. vivax* accounting for 96% of cases, and 55% occurring in migrants. Notably, *P. vivax* caused three deaths, with one further death attributed to *P. malariae*. In response to the outbreak, the roles and networks of village health volunteers have been expanded to include proactive case detection and BCC, with the adoption of minimum stock levels to prevent stockouts. In the six provinces with high burdens, outbreak response strategies were implemented under national and provincial oversight, whereas malaria services for nine refugee camps are managed by civil society organizations (CSOs).

The malaria surveillance system operates in real-time, following the 1-3-7 strategy. Responses involve reactive case detection, foci investigation with entomological surveillance, mass blood screening, vector control and BCC. Online procurement systems manage drug and commodity stocks. Microscopy quality control and proficiency testing maintain high accuracy rates, and the National Reference Laboratory aims to enhance capacity at the subnational level by establishing a network of reference laboratories across Thailand by 2024. Surveillance data inform risk stratification, planning, budget allocation, outbreak detection and intervention monitoring. Challenges include effective foci management and PoR in malaria-free areas, with integration for sustainability a top priority.

Key discussion points were as follows:

- *P. knowlesi* cases are concentrated in southern Thailand.
- Eight cases of *P. ovale* were introduced from Sudan.

Myanmar

Dr Toe Aung from the Shan State Public Health Department underscored the concerning trend in malaria cases, noting a substantial decline from 2012 to 2020, with cases more than doubling thereafter. While most cases were attributed to *P. vivax*, there was also an increase in *P. falciparum* cases in 2021 and 2022. Malaria remains concentrated in 20 townships with a high burden, along the borders with China and India in the north, Thailand in the south, and in the west.

A web-based malaria elimination-capable surveillance system with real-time, case-based, entomological surveillance has been developed, aiming for full implementation by 2025. Training is underway to facilitate the transition from paper-based to electronic reporting, with improved updating frequency. Surveillance data are used for risk stratification, forecasting, quantification, informing the national strategic plan, and monitoring and evaluation. Challenges are linked to the poor quality and timeliness of reporting, limited internet access, inadequate staff training, minimal engagement by the private sector, insufficient technical resources, and poor integration with the DHIS2 platform. Plans for building capacity, improving data visualization and importing historical epidemiological data are in progress.

Key discussion points were as follows:

- Artesunate monotherapy is prohibited but still available in some border areas in private clinics. Data on the extent of its use are not available, but since it is not cheaper than artemisinin-based combination therapy (ACT), the market for monotherapy is likely to be small.
- The spillover of malaria from Myanmar into neighbouring countries is concerning. Myanmar is training integrated community malaria volunteers (ICMVs) in border areas on case management, as well as strengthening vector control, distributing LLINs, routine IRS and reactive IRS. However, supplying and supporting ICMVs in areas of active conflict is unfeasible, and implementation depends on the security situation.
- There may be potential to involve further the private sector in the distribution of malaria drugs and LLINs.

Viet Nam

Dr Ngo Duc Thang from the National Institute of Malariology, Parasitology, and Entomology reported significant progress toward malaria elimination, with only 406 cases recorded to date in 2023 compared to 455 in 2022. Currently, 42 provinces are malaria-free, and 21 are actively working toward elimination. Malaria cases are concentrated among forest goers, ethnic minorities and migrant populations. The causes are mainly *P. vivax* (50%), followed by *P. falciparum* (25%) and *P. malariae* (24%).

Viet Nam operates a real-time malaria surveillance system, capturing case-level data and employing the 2-7 strategy for case identification, classification and investigation, with high compliance rates. The dashboard serves as a valuable tool, issuing warnings for foci investigation, supporting risk stratification and foci mapping, monitoring compliance with the 2-7 targets, managing stock and alerting to stockouts at the commune and district levels. The malaria surveillance guidelines have been updated, and improvements to the monitoring system and dashboard have been implemented. However, challenges persist, including reaching high-risk populations such as forest goers and ethnic minorities. There is also a concern about the risk of resurgence due to increased population movements following the lifting of COVID-19 restrictions. However, Viet Nam remains on the path toward malaria elimination with a robust surveillance system and strategic interventions.

Key discussion points were as follows:

- *P. malariae* was likely always present. As *P. malariae* infections are often asymptomatic, they are detected during active case detection. As *P. malariae* cases increase, so too does the number of all malaria cases.
- Ensuring the cost-effectiveness of diagnosis is a challenge. In areas where malaria has been eliminated, microscopy services could be reserved for the district level, but services require strengthening in areas of continuing transmission.
- Viet Nam is developing a PoR plan. As part of this process, populations at risk of malaria in elimination areas are being identified.

2.2.2 Malaria Elimination Database

Mr Rady Try from the WHO MME programme explained that the Malaria Elimination Database (MEDB) monitors progress toward malaria elimination by facilitating data-sharing among the GMS countries. The database was established to support national programmes and stakeholders by monitoring, publishing reports and informing advisory bodies about the progress of malaria elimination. It plays a crucial role in deploying resources effectively, analysing data and supporting coordination. However, granularity, reporting frequency and data breakdown vary among countries.

The plan for 2024–2026 focuses on including drug resistance data, enhancing data uses and analyses, deploying mobile applications and improving data collection by deploying an automated synchronized service application. Specific support is being provided to Myanmar to roll out the new integrated malaria case-based reporting system. Support from the countries is sought to obtain data

synchronization permissions, share detailed foci information and share data from at least the sub-provincial level and ideally at the village level to identify cross-border outbreaks.

Key discussion points were as follows:

- The MEDB does not replace national malaria information systems, but synchronized uploading of national data to the MEDB would reduce errors and improve the timeliness of information.
- Ideally, data would be uploaded weekly, and countries are asked to work towards this target.

2.2.3 Assessment of surveillance system

Dr Rita Reyburn from the WHO country office in the Lao People's Democratic Republic and Dr Ngo Duc Thang, National Institute of Malariology, Parasitology and Entomology, Viet Nam, presented findings from the malaria surveillance assessments conducted using the WHO Malaria Surveillance Assessment Toolkit. The assessments aimed to evaluate the adequacy of malaria surveillance systems, identify gaps and prepare the two countries for elimination certification.

Lao People's Democratic Republic
Sampled provinces included those with burden reduction districts, elimination districts, and those with no reported malaria cases in the past five years. The assessment encompassed a quantitative survey, document review and data quality assessment at national, provincial and service delivery levels. Key findings highlighted performance indicators, information systems, case management, recording, analysis, data quality assurance, data access, governance, supervision and the proficiency of surveillance staff. In total, 26 recommendations were made, with 10 earmarked for immediate action. Achievements included the successful implementation of four priority recommendations and the overall effectiveness of malaria surveillance. Challenges included existing surveillance gaps and the inapplicability of some assessment indicators to the Lao People's Democratic Republic. The next steps involve implementing the remaining recommendations, addressing challenges and conducting future surveillance assessments for ongoing progress monitoring.

Key discussion points were as follows:

- The assessment gathered preliminary results within two months, facilitated by the toolkit with technical support from WHO and the Clinton Health Access Initiative. A digital data collection tool developed by the WHO country office could benefit other countries.
- Data were collected and analysed from different levels of the health system but consolidated for the presentation.
- No monitoring visits were conducted in the private sector.

Viet Nam
The assessment comprised initiation, data collection, review and analysis, with continuous prioritization and dissemination. The toolkit featured ready-to-use tools, ensuring offline accessibility and data monitoring capabilities. The survey progress at province, district and commune levels revealed positive performance indicators related to data use, contextual understanding, technical knowledge and behaviour. Data quality assurance checks were conducted to ensure concordance with patient information. Viet Nam used 71 of the 79 proposed indicators, combining desk reviews, surveys and data quality assessments. Improved training is needed to correctly identify imported cases and improve awareness of the need for polymerase chain reaction (PCR) genotyping. Future actions include repeating the assessment every three to five years, implementing recommendations and maintaining ongoing progress monitoring.

2.3 Cross-border activities

2.3.1 WHO perspective

Dr Deyer Gopinath from the WHO country office in Thailand provided insights into the complexities of eliminating malaria in territories with land boundaries. Border malaria, often cited as a hurdle to elimination, is defined as potential transmission along shared land borders where at least one country has ongoing malaria transmission. Factors contributing to transmission in border areas include receptivity, efficient vectors, forested areas, and the social, economic, and political environment. There may be a transmission gradient across the border, with a higher malaria burden in one country and a lower one in the other, requiring different approaches.

The importance of cross-sector and cross-border collaboration was highlighted, emphasizing the need for clear objectives and responsibilities, joint activities, information-sharing mechanisms and resource mobilization. Key areas of action include defining the malaria problem in border areas, early planning and management, and fostering collaborative efforts for sustainable progress. In addition, effective programming requires granular analysis, robust evaluation of interventions and an increased focus on improving access and coverage along borders. The importance of regional data-sharing platforms was stressed for enhanced surveillance and response in cross-border collaborations.

Key discussion points were as follows:

- Setting clear objectives in collaboration is crucial. Terms of reference may be helpful if not overly proscriptive, but the critical elements are information sharing and the exchange of capacity.
- Mosquitoes may be dispersed by the wind, so vector importation distances may be greater than anticipated.

2.3.2 CSOs perspective

Professor Maxine Whittaker presented the perspective of the CSO Platform, a network of communities and CSOs addressing malaria in the GMS. Established in 2014, the platform engages 60 nongovernmental organizations, community-based organizations and networks focusing on knowledge sharing, capacity-building and advocacy. Their expanding scope includes support for equitable and sustainable integrated health services. The CSO Platform has initiated knowledge-sharing activities and workshops on PoR, learning from Thailand's PoR implementation for CSOs and as requested for other GMS countries, with support from the Thai Ministry of Health. Outcomes from the PoR workshop emphasized the role of CSOs in supporting government notification processes, strengthening community-based surveillance and enabling potential integration within donor-funded structures.

As part of this process, the CSO Platform has been engaged in discussions with the Mekong Basin Disease Surveillance Network (MBDS). The MBDS aims to reduce the impact of outbreak-prone diseases through regional cooperation. Malaria cases are reported monthly on the network, but there may be opportunities for surveillance and reporting for PoR. The CSO Platform suggested engaging the MBDS in future WHO discussions for transition planning for PoR.

Key discussion points were as follows:

- Discussions took place between WHO and the MBDS about 10 years ago. However, at that time, their objectives and resources were not aligned. Now, there is an opportunity to revisit the potential for collaboration.

2.4 Monitoring antimalarial drug efficacy and resistance

For Day 2, the chair was Dr Rungrawee Tipmontree from the Division of Vector Borne Diseases, Thailand, and the co-chair was Dr Siv Sovannaroth from the National Center for Parasitology, Entomology and Malaria Control, Cambodia.

2.4.1 Country updates

Cambodia
Dr Rithea Leang from the National Center for Parasitology, Entomology and Malaria Control confirmed that the high efficacy of artesunate-mefloquine (AS-MQ) and AS-PY against *P. falciparum* and AS-MQ against *P. vivax,* based on TES results from 2020–2022. TES was ongoing in three provinces in 2023. iDES protocols were developed in 2022, and the programme was implemented in selected districts of 10 provinces with the engagement of partners in these provinces. Enrolment is suboptimal, and challenges included the poor quality of slides for microscopy, slow engagement of village health workers, remoteness of cases from the care point, and the absence of internet connections affecting data entry. Plans emphasize the need for refresher training, particularly on slide preparation and monitoring, improved dashboards, review meetings with field visits and regular wrap-up discussions to resolve challenges.

Lao People's Democratic Republic
Dr Keobouphaphone Chindavongsa from the Centre of Malariology, Parasitology and Entomology confirmed the high clinical and parasitological efficacy of artemether-lumefantrine (AL) against *P. falciparum* and *P. vivax*, based on TES results from 2019–2023. The National Treatment Guidelines were updated to include AL in the first trimester of pregnancy. Additionally, the guidelines now include *P. vivax* radical cure, involving seven-day PQ treatment plus G6PD quantitative testing or an eight-week PQ regimen where G6PD testing is not available, but adherence can be assured through follow-up. iDES was scaled up, with challenges in data collection and follow-up due to operational, budgetary and human resource constraints, as well as a highly mobile population. Capacity-building is needed to ensure microscopy quality control. The next steps involve district-level integration of intervention into the malaria rapid response teams.

The key discussion point was as follows:

- Participation in TDA is high in the Lao People's Democratic Republic (>90% first round, >80% second round).

Thailand
Ms Patcharida Boondej from the Division of Vector Borne Diseases presented the iDES results. The efficacy of dihydroartemisinin-piperaquine (DHA-PPQ) against *P. falciparum* remains high despite the Thai–Myanmar border outbreak. However, lower follow-up rates in 2023 compared to 2022 reflect a higher malaria burden. Molecular marker surveillance reveals ongoing *P. falciparum* Kelch 13 (*Pf*K13) evolution without mefloquine (MQ) resistance. Concerns arise from high rates of *P. vivax* recurrence in school-age children, requiring further PQ adherence verification. Paediatric PQ is unavailable, but a new scored 15 mg tablet is under development to support weight-based dose adjustment. Feasibility studies on *P. vivax* radical cure with seven-day PQ or TQ treatment are ongoing. Quantitative G6PD testing and TQ implementation in six high-burden provinces are planned for 2024, and mass drug administration (MDA) with chloroquine (CQ) is being considered. Future steps involve integrating molecular marker data into iDES, quantifying drug adherence, improving reporting quality, improving adherence to second-line treatment and addressing iDES dashboard bottlenecks. A video outlining the aims, process and outcomes of iDES was also shown.

Key discussion points were as follows:

- The reversal in MQ resistance markers suggests three ACTs would have sufficient clinical efficacy in Thailand.
- BCC activities were conducted around PQ adherence in schoolchildren in 2022 in two high-burden provinces, and understanding the impact of these activities would be valuable.

Myanmar
Dr Toe Aung from the Shan State Public Health Department presented the TES results from 2019–2022, following improvements to data management to increase compliance with WHO protocols. There was a sustained high efficacy of AL, DHP-PQP and CQ. The National Treatment Guidelines were modified to include AL for all pregnant women and 14-day or seven-day PQ treatment for mixed infections and non-*P. falciparum* malaria. Country priorities for the 2024 TES focus on treatment efficacy in Buthidaung Township, Rakhine State. Increasing malaria prevalence, the need for molecular surveillance, and training courses for laboratory staff are key considerations, and additional budget is needed for operational research. Microscopy external quality assurance was conducted in 2022 and 2023, and a framework for quality assurance was established with training activities in 2023 and planned for 2024. Challenges include funding issues, operational obstacles and a shortage of technical staff.

Viet Nam
Dr Huynh Hong Quang from the National Institute of Malariology, Parasitology and Entomology presented the TES results from 2021–2023, revealing high rates of PCR genotyping-adjusted efficacy for PY-AS, with two treatment failures in 2023 yet to be classified. Day 3 positivity rates are 50%, consistent with the high prevalence of *Pf*K13 markers. Molecular surveillance indicates a decline in piperaquine (PPQ) resistance since AS-PY replaced DHA-PPQ, with no MQ resistance. iDES is being implemented in three central provinces against a background of declining malaria prevalence. However, iDES is not sustainable because of a lack of malaria specialist staff, insufficient funding for follow-up and limited data analysis capabilities. Another challenge is the complex malaria situation in Khanh Hoa province, where *P. vivax* and *P. malariae* predominate. The National Treatment Guidelines have been updated to address non-falciparum species, including *P. vivax* radical cure with seven-day PQ treatment based on G6PD status, and to allow for alternative ACTs where AS-PY is not available. Priorities for 2024 include expanding iDES, investigating the high incidence of *P. malariae* cases, piloting CQ plus TQ *P. vivax* radical cure and quantitative G6PD screening, improving surveillance of symptomatic and asymptomatic malaria and making modifications to support timely data reporting.

Key discussion points were:

- For iDES, it was suggested that PQ follow-up should be extended to 90 days.
- Despite the high prevalence of *Pf*K13 mutants associated with artemisinin partial resistance, this should not prevent the country from achieving malaria elimination, particularly as three ACTs appear to have sufficient efficacy in Viet Nam.
- The increase in *P. malariae* cases is concerning, and further investigation is required.

2.4.2 Updates and trends on molecular markers in the GMS

Dr Nimol Khim of the Malaria Research Unit at the Institut Pasteur in Cambodia provided an update on molecular markers associated with antimalarial resistance in *P. falciparum* parasites in Cambodia, the Lao People's Democratic Republic and Viet Nam. Notably, there are no verified molecular markers for pyronaridine or lumefantrine. The data revealed selection of the *Pf*K13 Y493H mutant in western Cambodia, with no selection of MQ resistance and a decrease in PPQ resistance markers. A suspected case of AS-PY treatment failure in a 4-year-old child was investigated, highlighting the need for venous blood collection at day 0 for all *P. falciparum* cases to define the phenotype through *in vitro* drug testing. In the Lao People's Democratic Republic, there was a significant increase in *Pf*K13 C580Y, suggestive of importation, but no changes in MQ or PPQ resistance markers, which remained at low prevalence. There was a significant increase in polymorphisms of *P. falciparum multi-drug resistance 1*, potentially indicating selection by lumefantrine and the need for further genomic analysis. In Viet Nam, there was no change in *Pf*K13 markers, no selection of MQ resistance and a decrease in PPQ resistance prevalence. The presentation highlighted the need for continued vigilance and investigation to inform effective antimalarial strategies in the region.

Key discussion points were as follows:

- Although some efficacious ACTs appear to select for certain mutations, the mutations are not necessarily associated with resistance. Also, sporadic failures may be caused by a lack of supervision or insufficient drug levels in the blood rather than resistance.

2.4.3 Updates and trends on molecular markers in the Lao People's Democratic Republic

Dr Moritoshi Iwagami of the Institut Pasteur du Laos and the National Center for Global Health and Medicine presented updates on *Pf*K13 mutations in 2015–2017 in five southern provinces. The data revealed an overall decline, with considerable variation and a lower prevalence towards the north compared to the south. The main mutations were C580Y, but Y493H, R539T and P574L were also detected. A study in Attapeu revealed a 6.5% (32/494) prevalence of asymptomatic *Plasmodium* carriage, indicating the need to define the transmission reservoir. Additionally, an evaluation of loop-mediated isothermal amplification (LAMP) diagnostic testing was performed, indicating slightly lower sensitivity and specificity than PCR, but offering simplicity and ease of use. LAMP screening indicated that 3.7% (28/750) of suspected malaria cases, which tested negative based on a rapid diagnostic test (RDT), were carrying *Plasmodium* in Sekong.

During the screening for asymptomatic carriers in Savannakhet in 2019–2020, 34 carriers were identified using RDT, and 66 were detected using PCR, which was particularly effective in detecting *P. vivax* infections compared to RDT. Molecular analysis revealed that samples were either *Pf*K13 wild type or could not be analysed because of the low parasite biomass. To enhance *Plasmodium* detection, a malaria LAMP system is planned for installation in high-burden districts, and an index survey will be conducted as a Science and Technology Research Partnership for Sustainable Development (SATRPS) project. Additionally, capacity development efforts involve PCR training for staff from the Center for Malariology, Parasitology and Entomology at Institut Pasteur du Laos.

2.4.4 Monitoring and quality control of TES and iDES in the GMS countries

Dr Maria Dorina Bustos from the WHO country office in Thailand provided an overview of WHO tools for monitoring antimalarial drug efficacy, including TES protocols, methods for PCR genotyping to differentiate reinfection from recrudescence, a data entry and analysis tool, quality control checklists and the parasite clearance estimator. Dr Bustos discussed deviations from the WHO TES standard protocol, covering site selection, sample size calculation, microscopy quality assurance and adherence to template requirements. She emphasized the need to ensure supervised treatment, including seven-day PQ treatment for *P. vivax*, and stressed the importance of correctly classifying treatment outcomes, particularly the exclusion of cases that develop severe malaria within 24 hours of treatment initiation. To ensure valid comparisons of data between sites and over time, molecular methods must be clearly described. Challenges in TES involve registering a clinical trial before the study starts, completing patient follow-up, maintaining accurate microscopy records, and completing and validating data entry.

iDES is being implemented in elimination areas as part of routine surveillance to ensure appropriate treatment and complete cure. Dr Bustos discussed issues such as loss to follow-up, laboratory quality control and treatment availability. She highlighted the need to collect data on day 0 when the patient presents and the end day, marking the end of follow-up with confirmed cure or the day of failure. Treatment must be supervised, and treatment failures must receive second-line therapy (supervised) and be followed up for an additional period. Dr Bustos explained the mandatory and recommended iDES activities concerning treatment, follow-up, diagnosis and molecular analysis. She concluded her presentation by addressing ongoing challenges and the need for continued training on surveillance and data analysis.

Key discussion points were as follows:

- iDES is suitable for elimination areas with low caseloads, but it is challenging to deliver in the outbreak areas in Thailand.

- The 90-day follow-up for *P. vivax* cases is generally not practical and does not provide any information on whether these cases are relapses or reinfections.
- Identification of asymptomatic cases is a key objective in areas targeting elimination. However, since LAMP costs around US$ 6, it is more expensive than RDTs.

2.5 Plasmodium vivax

2.5.1 *P. vivax* challenges in control and elimination

Dr Kevin Baird from the Oxford University Clinical Research Unit, Indonesia, emphasized the misconceptions surrounding *P. vivax* malaria, previously considered a mild, self-limiting infection. Recent evidence challenges the notion that *P. vivax* is harmless, revealing its danger to hospitalized patients is comparable to that of *P. falciparum*. Because *P. vivax* targets early reticulocytes, it has significant pathogenic biomass in erythropoietic sites, occurring in bone marrow, spleen and liver. Consequently, blood-based diagnostics do not accurately reflect the presence, prevalence or scale of the threat from *P. vivax.* In fact, active *P. vivax* malaria can occur even without patent parasitaemia (termed tenebrous malaria). Parasite lactate dehydrogenase is a potential biomarker for *P. vivax* biomass.

The importance of addressing the hypnozoite reservoir with radical cure was highlighted. Repeated relapses over prolonged periods undermine patient health and increase the risk of subsequent hospitalization and death. This risk is driven mainly by increasing anaemia and the proliferative expansion of harmful biomass in the erythropoietic organs. Thus, radical cure aims to reduce cases and transmission and protect the health of the individual patient. The complexity and challenges of *P. vivax* radical cure were acknowledged, including uncertainty around 8-aminoquinoline doses, the impact of the blood schizonticide on radical cure efficacy, and the effect of cytochrome 2D6 polymorphism on PQ exposures. Haemolytic risk in G6PD deficiency and the need for appropriate G6PD testing with both PQ and TQ were emphasized. Overall, a pragmatic perspective on managing *P. vivax* was suggested, emphasizing the need for tailored interventions for both patients and communities.

Key discussion points were as follows:

- The same strategies used successfully to accelerate *P. falciparum* elimination cannot be applied to *P. vivax* elimination; specific approaches are required. Attempting to eliminate *P. vivax* without addressing the hypnozoite reservoir will take a long time and be dangerous for patients.
- While there is little evidence that weekly PQ for eight weeks is efficacious, an upcoming publication based on the PRIMA study provides support for its high recurrence prevention efficacy.
- MDA with CQ for four months is an option to suppress relapses as successive hypnozoites become reactivated and should be evaluated operationally.
- Few deaths in the GMS are associated with *P. vivax* as severe disease caused by *P. vivax* occurs only if there is delayed access to care or suboptimal care for acute malaria. However, repeated vivax malaria episodes can cause patients to be more susceptible to other infections and health conditions, and so the contribution of malaria may not be recognized.
- The effective PQ dose in the GMS appears to be at least 0.5 mg/kg/day for seven days, though higher doses are being assessed.

2.5.2 Update on PAVE studies

Dr Soy Ty Kheang presented on behalf of the Partnership for Vivax Elimination (PAVE), a collaboration between Medicines for Malaria Venture and PATH. PAVE consolidates investments from multiple organizations and collaborates with national malaria programmes, CSOs, technical partners and research partners. PAVE also supports the Asia Pacific Malaria Elimination Network vivax working group. PAVE aims to improve *P. vivax* case management and accelerate the reduction of vivax malaria to ultimately achieve elimination.

PAVE facilitates readiness for introducing new tools from the pipeline through a structured approach, involving situational analyses, readiness workshops, evidence collation and tool preparation. The partnership also tracks and addresses bottlenecks related to regulatory approvals, WHO recommendations and national regulatory submissions. Operational challenges include clinical trial registration, follow-up logistics, laboratory quality control, data entry and stock availability. Activities across the GMS countries include G6PD testing feasibility studies in the Lao People's Democratic and Viet Nam and the ARCTIC study in Thailand (see below). Going forward, a TQ and G6PD quantitative testing feasibility study is planned for Viet Nam, PQ radical cure with G6PD testing is supported in Myanmar, and a pilot of seven-day and eight-week PQ treatment is planned in Cambodia. The presentation emphasized the importance of continuous monitoring, training and surveillance in achieving *P. vivax* elimination.

Key discussion points were as follows:

- In areas with very low *P. vivax* malaria prevalence, the 12-month shelf-life of the G6PD tests is limiting, though a product with a 24-month shelf-life should be available in 2024.
- Regular refresher or on-the-job staff training is needed to maintain testing skills.

2.5.3 Update on the ARCTIC study

Dr Prayuth Sudathip from the Division of Vector Borne Diseases, Ministry of Public Health, Thailand, outlined the most recent findings from the ARCTIC study. The phase IV observational study is being conducted in Thailand to assess the operational feasibility of using quantitative G6PD testing prior to *P. vivax* radical cure with TQ or PQ. The primary outcome is whether *P. vivax* patients aged 16 years old and older were treated with TQ in accordance with the appropriate level of G6PD enzyme activity.

The ARCTIC study is being conducted in Yala and Mae Hong Son provinces, where routine quantitative G6PD testing has been available since 2020. Staff at all sites underwent re-training on G6PD testing and radical cure treatment protocols before the study. The study is conducted in two phases, beginning in higher-level health facilities and expanding to malaria clinics. Phase one has been completed, with high rates of adherence to the protocol for both TQ and PQ in the hospital setting and acceptable safety. Phase two is underway, and results will be reported in 2024. Findings from the ARCTIC study prompted the Ministry of Public Health to plan a scale-up of TQ and G6PD quantitative testing to six high-burden provinces in Thailand, including a G6PD test quality assurance system and enhanced pharmacovigilance.

The key discussion point was as follows:

- There is no mechanism to link a previous G6PD test with a recurrent episode, so G6PD status must be evaluated before each treatment with TQ or PQ in Thailand.

2.6 Subnational verification and prevention of re-establishment

For Day 3, Dr Virasack Banouvong from the Centre of Malariology, Parasitology and Entomology, Lao People's Democratic Republic, was selected as chair, and Dr Nguyen Quang Thieu from the National Institute of Malariology, Parasitology and Entomology, Viet Nam, was chosen as co-chair.

2.6.1 Guidance on subnational verification and prevention of re-establishment

Dr Elkhan Gasimov from the WHO Global Malaria Programme provided key insights into SNV and PoR. Introduced by WHO in 2017, SNV is recommended for large countries and those with subnational elimination goals. The process is owned and led by countries, with WHO offering technical support upon the ministry of health's request. Overall responsibility for SNV lies with the ministry of health, which must decide the verification method, define national and local authority roles and ensure adherence to official regulations. SNV should involve national malaria elimination committees and engage subnational government authorities, with the results well-documented. The criteria for

verification should align with the WHO process for certification of national malaria elimination, using evidence such as reports, documents and observations. The verification process may include readiness workshops, evidence collation and documentation. Countries benefit from SNV by preparing for final certification, advancing the elimination agenda and promoting ownership of malaria elimination at the subnational level.

PoR of malaria transmission is necessary until eradication, necessitating the management of receptivity and importation risk. Surveillance and response strategies around PoR should be integrated into public post-elimination health programmes, demanding a sustained political and financial commitment at both national and subnational levels. WHO is developing comprehensive guidance for PoR, involving case studies, evidence reviews, virtual meetings and a comprehensive review meeting. The guidance document is expected to be finalized and published by April 2024.

Key discussion points were as follows:

- WHO MME is conducting a meeting in June 2024 on the PoR guidelines and is supporting training at the country level.
- The PoR guidelines include more than 10 case studies, and a series of publications "towards a malaria free world" will examine specific elimination cases more fully.
- Maintaining government support for PoR is supported by the malaria certification process. While this process is voluntary, there is also a process for revoking certification, which could be politically embarrassing, depending on the circumstances. Regionally, as shown in Europe, it is helpful to have a commitment from the ministries of health towards PoR.
- Maintaining a separate malaria programme for PoR is not financially viable, so integration is key to sustainability. Integration of malaria services should start before elimination so there is a window to test the system's functionality before malaria-free certification.

2.6.2 Prevention of re-establishment: country experience: Sri Lanka

Professor Rajitha Wickremasinghe from the University of Kelaniya shared insights into Sri Lanka's PoR strategies. Following malaria-free certification in 2016, intensified surveillance employed a 1-2-5 model with immediate case notification and confirmation, case investigation within two days and response within five days. The Anti-Malaria Campaign was the sole institution that could provide antimalarials and confirm diagnoses through microscopy, with PCR confirmation for negative but suspected cases. All patients were admitted to hospital and treated according to the national treatment guidelines. Entomological surveillance was done as part of case investigation, at sentinel sites and through spot surveys. Vector control included larviciding and using larvivorous fish, LLINs and IRS. Awareness-raising was conducted with clinicians, travellers and at-risk groups, and collaboration was developed with clinicians, the private sector and other disease control units in the Ministry of Health. Operational research focused on improving diagnosis methods, increasing private sector contributions, optimizing diagnostics and investigating introduced cases, transfusion-induced malaria cases and one imported malaria death.

Challenges included high receptivity and importation risk, difficulties in maintaining interest in a low-burden scenario, the emergence of new vector species (*Anopheles stephensi*) and financial constraints. Maintaining technical skills required continued assessment and training for microscopists and quality assurance. Estimation of commodities and procuring small quantities of antimalarial drugs were problematic.

Integration of services involved devolved PoR services while maintaining a link to the central Anti-Malaria Campaign for technical guidelines and policy. This included a Technical Support Group and a Case Review Committee, ensuring strategic advice, technical inputs and case review. The COVID-19 pandemic disrupted work routines, but adaptations included monitoring international travel, screening incoming travellers for COVID-19 and malaria and conducting entomological surveillance. The financial transition from elimination to PoR involved funding from international partners, and the

programme underwent gradual termination of contracts and budget support measures. Case examples of introduced malaria, transfusion-induced malaria and a malaria-related death emphasized the need for continued vigilance.

Key discussion points were as follows:

- Historically, malaria could consume up to half of the public health budget, so there is a strong financial incentive to maintain PoR activities.
- As an island nation and with most malaria occurring in military personnel, Sri Lanka did not have to address the issues of cross-border malaria and mobile and migrant populations as is the case in the GMS.
- Imported cases included all species of human malaria, so maintaining microscope diagnosis skills was critical.
- The malaria death occurred because of delayed diagnosis. Maintaining awareness of malaria as a potential cause of fever and the importance of investigating travel history needs to be emphasized to travellers and clinicians.

2.7 Malaria elimination activities including subnational verification and prevention of re-establishment

2.7.1 Country updates

Cambodia

Dr Siv Sovannaroth from the National Center for Parasitology, Entomology and Malaria Control commented that Cambodia has secured an RAI4E grant and updated the surveillance and elimination guidelines and the national treatment guidelines. He reiterated the significant reductions in malaria cases achieved. However, challenges include identifying the source of domestically imported cases and engagement with forest and mobile workers. Going forward, a specific plan for *P. vivax* elimination is required, and *P. malariae* and *P. knowlesi* transmission need to be addressed. The SNV protocol and PoR guidelines will be piloted and scaled up in 2024, targeting national malaria elimination by 2028. The PoR guidelines include risk stratification, surveillance, integration of other vector-borne diseases and case and focus responses.

Key discussion points were as follows:

- From 2024, all malaria cases must have a confirmatory diagnosis by microscopy or PCR. The Malaria Rapid Response Teams will do microscopy and collect the dried blood spot for PCR. They will also use epidemiological and entomological investigations to define the source of every malaria case.

Lao People's Democratic Republic

Dr Phoutnalong Vilay from the Center of Malaria Parasitology and Entomology outlined the robust surveillance system, with comprehensive foci investigation and case classification. The outbreak in Nakai district underlines the need for continued vigilance in highly receptive areas and shows how an increasing case burden could overwhelm the 1-3-7 approach. Case classification criteria and the malaria testing algorithm will be updated in early 2024, and iDES will continue to be strengthened. Accelerator strategy coverage improved between 2021 and 2023, resulting in significant declines for both *P. falciparum* and *P. vivax* cases. Activities will continue in 2024, plus a specific strategy to accelerate *P. vivax* elimination, including TDA with CQ (four rounds). Subnational protocols are in place, with regular training, monitoring and support and a road map for national malaria-free certification by 2030. The PoR strategy is under development with the aim of building subnational capacity and achieving an integrated sustainable workforce trained in malaria surveillance and response.

Thailand

Dr Rungrawee Tipmontree from the Division of Vector Borne Diseases highlighted the situation in Myanmar as a threat to malaria elimination in Thailand, which is straining the surveillance system in the affected provinces. More resources are needed in refugee camps, and partners must urgently address

the malaria situation on the Myanmar side. The surveillance system is oriented towards elimination, providing real-time actionable data. Foci are clarified into four levels with tailored interventions, with a registry to track foci evolution based on interventions under development. Specific strategies are in place for *P. falciparum* and *P. vivax* elimination, including the implementation of seven-day PQ treatment nationally, TQ in the six outbreak provinces and TDA with CQ in Tak province. The process of SNV started in 2018, with 49 provinces passing validation, targeting national malaria elimination by 2028. Reintroduction of malaria transmission occurred in seven provinces, highlighting the need for robust PoR planning. Risk stratification has been conducted, and tailored PoR guidelines are in place for 47 provinces.

Key discussion points were as follows:

- The response to the increase in active foci is to strengthen proactive case detection and increase the number of malaria posts on the Thai–Myanmar border. Additional funding was sought from the Global Fund to Fight AIDS, Tuberculosis, and Malaria.
- Additional stocks of injectable artesunate were obtained, with a temporary shortfall being met through a donation from the President's Malaria Initiative.

Myanmar

Dr Toe Aung from the Shan State Public Health Department discussed the progress made towards a malaria elimination-capable surveillance system to support case-based surveillance, real-time reporting and timely responses along with stock management. Foci stratification was completed with WHO-recommended interventions for each stratum with the aim of eliminating *P. falciparum* malaria by 2026. The intensification of routine activities and accelerator strategies (MDA, TDA and IPTf) are being piloted in 2024 and rolled out in 2025. PQ is administered under family supervision, without directly observed therapy, and adherence needs improvement in some areas. Where the *P. vivax* burden is high, promotion of PQ adherence by ICMV or health staff and seven-day PQ treatment with G6PD testing require implementation. SNV is being considered for some regions. However, the malaria outbreaks on the eastern and western borders and the challenges of reaching remote or displaced populations means that the emphasis for the present is to strengthen surveillance, reduce burden and improve malaria case management.

Key discussion points were as follows:

- There is no experience in Myanmar with CQ MDA for *P. vivax* to reduce burden, though this is being considered.

Viet Nam

Dr Nguyen Quy Anh from the National Institute of Malariology, Parasitology and Entomology described the malaria elimination capable surveillance system and highlighted the decline in active foci since 2020. SNV commenced in 2019, with 46/63 provinces now in the PoR phase. PoR activities include surveillance, case management, vector control, quality assurance for malaria diagnosis, information, education and communication activities focused on migrant and mobile populations and stock management. Challenges include the erosion of skills and awareness where malaria is uncommon and funding constraints. Going forward, the SNV road map will be updated to support the 17 remaining provinces targeting malaria elimination by 2027. Additionally, the malaria microscopy system will be strengthened, and refresher training on malaria case management and surveillance will be conducted for both public and private health-care staff. The aim is to test all suspected malaria and engage advocacy and commitment to support malaria elimination.

Key discussion points were as follows:

- iDES contributes to readiness for PoR, as every case must be investigated.
- Entomological surveillance is conducted in receptive areas. Local malaria cases are an indirect measure of receptivity, and in remote areas, mass screening and treatment can be used to determine receptivity.

- Across the GMS, all countries undergo external quality assurance twice a year to support microscopy quality assurance. The reference slides are retained by the countries and can be used for regional training. However, a virtual slide bank for use by countries may also be useful.

2.8 Partner inputs

In the last session, representatives from partner organizations offered their thoughts and inputs.

Dr John Cox, representing the Bill & Melinda Gates Foundation, emphasized the severity and significance of *P. vivax* in the region. He acknowledged the positive steps taken to address the issue and highlighted the role of operational research in measuring impacts and fostering innovation. Dr Cox congratulated countries on their advancements in malaria elimination, specifically commending efforts related to SNV and PoR planning. However, he reiterated the importance of finalizing PoR plans in 2024, introducing necessary mechanisms and ensuring effective integration of malaria surveillance and services into the general health system as funding scales down.

Dr Tyson Volkmann, representing the United States Agency for International Development/President's Malaria Initiative, outlined the common challenges faced by GMS countries in malaria control. He underscored the benefits of collaboration and the significance of adopting a regional perspective. Dr Volkmann emphasized the need to structure and strengthen systems for better coordination, especially in supporting PoR, among countries sharing land borders.

Dr Faisal Mansoor, representing the United Nations Office for Project Services, expressed gratitude for countries' openness and transparency in sharing data and plans. He credited collaboration and WHO support as pivotal to progress. Dr Mansoor highlighted the challenges of addressing forest malaria, the gap in repellent provision and the ongoing difficulty in obtaining sufficient stocks of antimalarial drugs and commodities. He emphasized the necessity of a regional solution to address these challenges.

Professor Maxine Whittaker from the CSO Platform underlined the role of CSOs in supporting national malaria programmes in areas such as gender equality, disability and social inclusiveness, particularly for marginalized populations.

Dr Kyaw Zaw Myat, representing the International Rescue Committee, shared insights into the organization's support for approximately 90 000 individuals in refugee camps and temporary safe areas in Thailand. He highlighted that the risk of severe *P. vivax* malaria was underappreciated and emphasized the urgent need for increased funding and resources to address the security situation in Myanmar.

Ms Cecilia Hugo from the ACT Malaria Foundation emphasized progress in strengthening malaria microscopy capacity and quality across the region. She stressed the importance of SNV for retaining capacity and ensuring workforce security following integration into the general health system with the political and budgetary engagement of local government units.

2.9 Concluding remarks

Dr Pascal Ringwald thanked the participants for their attendance and support. A video of the meeting highlights was played.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

The main conclusions of the meeting were as follows:

- Cambodia, the Lao People's Democratic Republic and Viet Nam are approaching *P. falciparum* elimination, but the situation in Myanmar threatens to undo progress in Thailand and across the GMS.
- Current first-line drugs against *P. falciparum* and *P. vivax* are working effectively.
- New approaches are required to address *P. vivax* malaria, including the deployment of radical cure.
- PoR planning is a key additional activity for 2024.

3.2 Recommendations

3.2.1 Recommendations for Member States

Member States are encouraged to consider the following:

(1) Support improvements to the MEDB by:
   - providing a higher level of granularity (foci data, commune level, village level or equivalent);
   - increasing the frequency of data upload (weekly); and
   - facilitating automatic data upload.

(2) Further strengthen iDES by:
   - ensuring data entry and analysis for day 0 and end-point;
   - increasing follow-up rates, ensuring evaluation of outcomes, completing PCR assessments and linking molecular marker data.

(3) Improve through continued monitoring the quality of therapeutic efficacy study (TES) implementation based on the WHO protocol and quality control checklist.

(4) Continue to strengthen microscopy with quality assurance and quality control.

(5) Implement *P. vivax* radical cure through:
   - PQ (plus CQ or ACT) with qualitative or quantitative G6PD testing;
   - PQ (weekly for eight weeks, plus CQ or ACT) without G6PD testing;
   - TQ (plus CQ) with quantitative G6PD testing; and
   - consider further revisions based on upcoming WHO recommendations.

(6) MDA with CQ for four monthly rounds in *P. vivax* foci is an option to prevent relapses; however, ensure that sufficient CQ stocks are available in advance.

(7) Increase awareness of the risk of *P. falciparum* importation from travellers returning from African countries.

(8) Continue to explore opportunities for cross-border collaboration to address malaria foci across land borders.

(9) Continue to strengthen elimination activities for case classification, case investigation and foci response.

(10) Continue to strengthen stock management by exploring options for collaboration to secure the availability of medicines.

(11) Implement SNV to support the national elimination certification process.

(12) Prepare to develop or update PoR plans in 2024 and incorporate these into national strategic plans.

3.2.2 Recommendations for WHO

WHO is requested to do the following:

(1) Advocate for an elevated sense of urgency in responding to the situation along the Myanmar border, in particular the Thai–Myanmar border, as this situation threatens to undermine the gains made in the GMS over the last decade.
(2) Continue to facilitate cross-border collaboration and engagement with migrant and mobile populations by encouraging engagement from related agencies.
(3) Include the malaria surveillance application developed for the Lao People's Democratic Republic as an additional resource for the malaria surveillance assessment toolkit.
(4) Explore the potential contribution of the Mekong Basin Disease Surveillance Network for learning and/or as a mechanism for strengthening cross-border malaria surveillance.
(5) Raise awareness of the potential severity of *P. vivax* by:
    - including *P. vivax* in the update to the severe malaria guidelines;
    - updating WHO treatment guidelines for quantitative G6PD testing and *P. vivax* radical cure based on emerging evidence; and
    - disseminating available information on MDA with CQ for *P. vivax*.
(6) Consider conducting a technical evaluation on non-falciparum and non-vivax malaria species.
(7) Highlight the risk of imported *P. falciparum* malaria from Africa and the potential for importation of drug-resistant strains.
(8) Continue to support TES and iDES and any necessary updates to national treatment guidelines; consider reporting standardized indicators in the iDES guidance to allow comparison across countries.
(9) Continue to support the strengthening of microscopy services by investigating the possibility of online or virtual resources for microscopy training.
(10) Continue to support countries with their elimination strategies.
(11) Provide support to countries for SNV.
(12) Support countries in developing their PoR plans in 2024 and incorporating them into national strategic plans.
(13) Explore potential solutions to ensuring drugs and commodities stocks across the GMS, both to support elimination and to ensure supplies are adequate even after malaria-free certification.

ANNEXES

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Annex 2. Meeting programme

Wednesday 15 November 2023		
Chair: Dr Chea Huch, Deputy Director, CNM, Cambodia **Co-chair: Dr Tint Naing, Director, Myanmar**		
Session 1: Opening ceremony		
8:00-8.30	Registration	
8.30-9:00	Opening remarks Objective of the meeting, self-introduction of the participants and nomination of the Chair Administrative - meeting rules and announcements Group photo	aWR Cambodia Pascal Ringwald Sreyleak Kheng All
Session 2: Status of malaria surveillance (30 minutes presentation and 15 minutes discussion)		
9:00-10:30	Country updates: • Short briefing on malaria epidemiology • Analysis and distribution of cases and death (disaggregated data: imported vs indigenous) • Readiness of surveillance for malaria elimination • Use of surveillance data for actions (stratification, outbreak response) • Quality control of microscopy and reference lab • Private sector: referral and reporting • Achievements and challenges	Cambodia Lao PDR
10:30-11:00	Coffee/tea break	
11:00-12:30	Country updates (continued):	Thailand Myanmar
12:30-13.45	Lunch	
13:45-14:30	Country updates (continued)	Viet Nam
14:30-15:00	Malaria Elimination Database (MEDB) • Status on data shared • Data needed and support from NMP • Perspectives for RAI4E	Rady Try
15:00-15:45	Assessment of surveillance system: • Lao PDR • Viet Nam	Rita Reyburn Nguyen Thieu
15:45-16:15	Coffee/tea break	
Session 3: Cross border activities		
16:15-17:15	Cross border activities: • WHO perspective • CSOs perspectives and activities	Deyer Gopinath Maxine Whittaker
17:15-17:30	Closing remarks	James Kelley
17:30-19:00	**Welcome reception**	

Thursday 16 November 2023		
Chair: Dr Rungrawee Tipmontree, Public Health Technical Officer, Thailand **Co-Chair: Dr Siv Sovannaroth, Chief of Technical Bureau, CNM, Cambodia**		
Session 4: Monitoring antimalarial drug efficacy and resistance (20 minutes presentation and 10 minutes discussion)		
8:30-10:30	Country updates: • TES and iDES results • Molecular markers • Plans and studies needed	Viet Nam Thailand Myanmar Lao PDR
10:30-11:00	Coffee/tea break	
11:00-11:30	Country updates (continued):	Cambodia
11:30-11:50	Updates and trends on molecular markers in the GMS	Nimol Khim
11.50-12.10	Updates and trends on molecular markers in Lao PDR	Iwagami Moritoshi
12:10-12:30	Monitoring and quality control of TES and iDES in the GMS countries: country implementation challenges, data analysis, improvement needed	Dorina Bustos
12:30-14:00	Lunch	
Session 5: *Plasmodium vivax*		
14:00-15:30	*P. vivax*: challenges in control and elimination Questions and discussion	Kevin Baird All
15:30-16:00	Coffee/tea break	
16:00-16:30	Update on PAVE studies	Soy Ty
16:30-17:00	Update on ARCTIC study	Prayuth Sudathip (virtual)
17:00-17:15	Closing remarks	Risintha Premaratne

Friday 17 November 2023		
Chair: Dr Virasack Banouvong, Director, CMPE, Lao PDR **Co-Chair: Dr Nguyen Quang Thieu, Deputy Director, NIMPE, Viet Nam**		
Session 6: Subnational verification and prevention of re-establishment (20 minutes presentation and 10 minutes discussion)		
9:00-9:30	Guidance on sub-national verification and prevention of re-establishment	Elkhan Gasimov
9:30-10.00	Prevention of re-establishment: country experience: • Sri Lanka	 Rajitha Wickremasinghe
10:00-10:30	Coffee/tea break	
Malaria elimination activities including subnational verification and prevention of re-establishment in GMS countries (30 minutes presentation and 15 minutes discussion)		
10:30-12:00	Country updates: • Current strategy to eliminate malaria with focus on *P. vivax* • Case definition, case and foci investigation • Intensification plan • Innovative approaches • Stock and commodities • Sub-national verification • Prevention of re-establishment strategy	 Cambodia Lao PDR
12:00-13:30	Lunch	
13:30-15:45	Country updates (continued):	Myanmar Thailand Viet Nam

15:45-16:15	Coffee/tea break	
Session 7: Closure session		
16:15-17:00	Partners input	Partners
17:15-17:30	Conclusion, next steps and recommendations	Pascal Ringwald

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