



THE MEKONG MALARIA ELIMINATION PROGRAMME

ACCELERATING MALARIA ELIMINATION IN THE GREATER MEKONG

BULLETIN #10
MARCH 2022



World Health
Organization

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Contents

Acknowledgements	v
Abbreviations and acronyms	vi
Executive summary	vii
2021: Overview of malaria in the Greater Mekong	1
Malaria surveillance systems	7
Reaching the unreached: community malaria networks in the GMS	11
The COVID-19 pandemic and malaria: impact and responses in the GMS	15
GMS malaria elimination timeline and key targets	18
Malaria situation in the Greater Mekong countries	20
Cambodia	21
China (Yunnan Province)	22
Lao People's Democratic Republic	23
Myanmar	26
Thailand	28
Viet Nam	29
Accelerator strategies and focalized innovative approaches	33
Antimalarial drug efficacy	37
Reflections from malaria donors	38
Conclusion	43
References	47
Annex: malaria country profiles	49
Cambodia	50
China (Yunnan Province)	52
Lao People's Democratic Republic	54
Myanmar	56
Thailand	58
Viet Nam	60

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Abbreviations and acronyms

ACT	artemisinin-based combination therapy
CMPE	Center for Malaria, Parasitology, and Entomology (Lao People's Democratic Republic)
CNM	National Center for Parasitology, Entomology and Malaria Control (Cambodia)
COVID-19	coronavirus disease 2019
DHIS2	District Health Information Software 2
DVBD	Division of Vector Borne Diseases (Thailand)
GMS	Greater Mekong subregion
G6PD	glucose-6-phosphate dehydrogenase
HIV	human immunodeficiency virus
iDES	integrated drug efficacy surveillance
IMPE	Institute of Malariology, Parasitology, and Entomology (Viet Nam)
IPTf	intermittent preventive treatment for forest goers
LLIHN	long-lasting insecticidal hammock net
LLIN	long-lasting insecticidal net
MME programme	Mekong Malaria Elimination programme
NIMPE	National Institute of Malariology, Parasitology, and Entomology (Viet Nam)
NMCP	National Malaria Control Programme (Myanmar)
PPE	personal protective equipment
RAI	Regional Artemisinin-resistance Initiative
TDA	targeted drug administration
TES	therapeutic efficacy studies
WHO	World Health Organization

Executive summary

The Greater Mekong subregion (GMS) countries continue to make promising progress towards the targets outlined in the *Strategy for malaria elimination in the Greater Mekong subregion: 2015–2030(1)*. In 2021, the six GMS countries – Cambodia, China (Yunnan Province), Lao People’s Democratic Republic, Myanmar, Thailand and Viet Nam – reported 65 297 malaria cases, a 16% reduction from 2020; approximately 1000 of these cases were imported.¹ China was the first country in the GMS to be certified as malaria-free by the World Health Organization (WHO), on 30 June 2021.

Viet Nam was the country with the lowest number of indigenous² cases (407). Myanmar had the highest caseload (53 314), constituting 82% of all cases in the GMS.

The subregion recorded 9310 *Plasmodium falciparum* + mixed cases³ in 2021, placing most countries on track for the 2023 elimination goal for *P. falciparum*. From 2020 to 2021, *P. falciparum* + mixed cases decreased by 52%. Thailand recorded 70 *P. falciparum* + mixed cases, the lowest among the GMS countries.

All GMS countries continue to make progress in curbing malaria mortality. A total of 15 malaria deaths were reported in the six countries in 2020, compared with 27 deaths the previous year.

Testing rates continue to reflect the active case detection approaches adopted by the GMS countries. The test positivity rate across the GMS was 1.3%. More than 4.8 million tests were performed in 2021, a 38% decrease from 2020.

Malaria data continue to be regularly shared by national malaria programmes with the Mekong Malaria Elimination programme’s Malaria Elimination Database. GMS countries are increasingly adopting elimination surveillance mechanisms that are capable of reporting, investigating and clearing cases and foci.


Focalized innovative approaches encompassing targeted drug administration and intermittent preventive treatment for forest goers were launched in Cambodia and Lao People’s Democratic Republic. These approaches were combined with vector control, case management and community engagement activities to accelerate *P. falciparum* elimination, in line with the GMS targets.

The GMS countries continued to prevent the spread of antimalarial drug resistance by monitoring drug efficacy and making the necessary changes to national treatment guidelines. With decreasing caseloads, national malaria programmes continue to support the transition to integrated drug efficacy surveillance and use their routine surveillance systems to track treatment outcomes and the follow-up of malaria cases.

¹ Imported cases are malaria cases or infections in which the infection was acquired outside the area in which it is diagnosed.

² Indigenous cases are cases contracted locally with no evidence of importation and no direct link to transmission from an imported case.

³ Mixed cases are cases identified with more than one *Plasmodium* species. In the GMS, these are primarily mixed with *P. falciparum* malaria.



Ksor Y Khet, 41, a village health worker, performs a malaria rapid diagnostic test on a member of his community in Gao Village, Phu Yen Province, Viet Nam.

© WHO/L. Pham





2021: Overview of malaria in the Greater Mekong

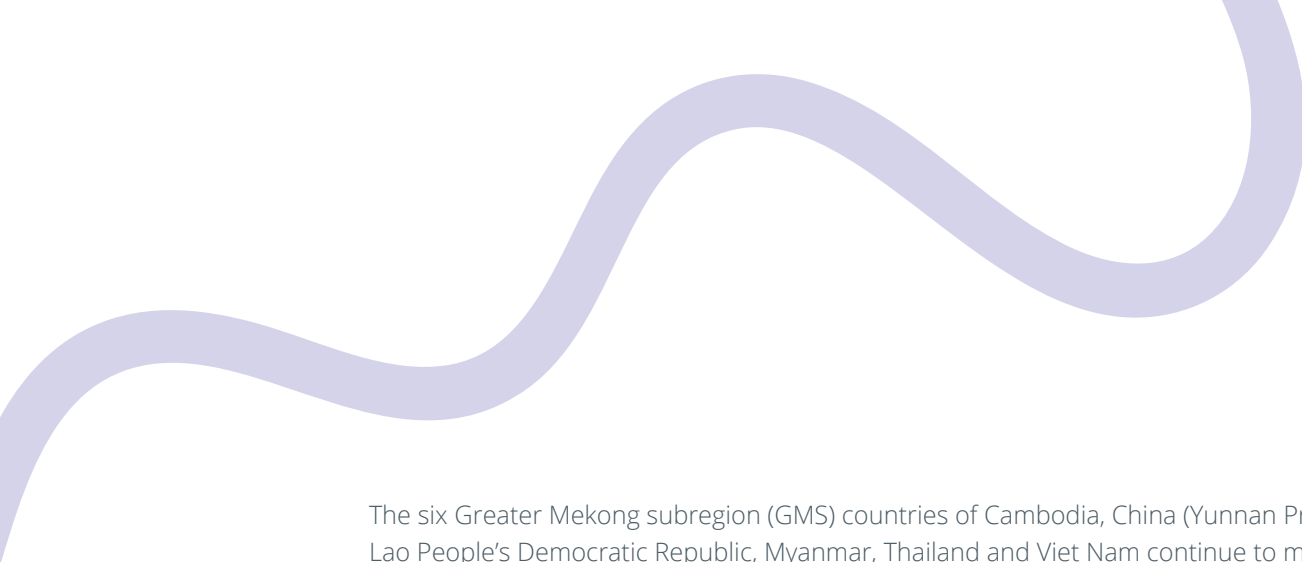
KEY MESSAGES

The Greater Mekong subregion (GMS) continues to witness a steady momentum towards malaria elimination. In 2021, the GMS reported 65 297 malaria cases, a 16% decrease from 2020.

Although antimalarial drug resistance remains a concern, the GMS has seen promising results in *Plasmodium falciparum* elimination. There were 52% fewer *P. falciparum* + mixed cases in 2021 than in 2020. This is an important milestone in the ongoing efforts to reduce the threat of antimalarial resistance.

Despite the rise in COVID-19 transmission across the GMS, national malaria programmes continued to adapt and implement World Health Organization guidance to maintain essential malaria services during the pandemic. Disruptions were largely avoided as countries secured supplies of malaria commodities and maintained their malaria activities, including testing.

China's malaria-free status provides an important blueprint for the subregion. More and more countries are beginning to prepare for the process of applying for malaria-free certification. GMS countries are increasingly adopting programming methods for low-burden settings. These accelerated elimination approaches are crucial for reaching high-risk communities such as forest goers and mobile populations.



The six Greater Mekong subregion (GMS) countries of Cambodia, China (Yunnan Province), Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam continue to move closer to their collective targets to eliminate *Plasmodium falciparum* malaria by 2023 and all forms of human malaria by 2030. In 2021, the GMS countries reported 65 297 malaria cases⁴ – and 9310 *P. falciparum* + mixed⁵ cases (Figs. 1–3). Malaria testing decreased by 38% from 2020 to 2021, with just over 4.8 million tests performed in 2021. Overall, first- and second-line artemisinin-based combination therapies (ACTs) continue to demonstrate high efficacy; when high treatment failures have been detected, countries have updated their treatment guidelines accordingly.

Several important malaria milestones for the GMS occurred during 2021. China was the first country in the GMS to be certified by the World Health Organization (WHO) as malaria-free, on 30 June 2021. The country recorded its last indigenous⁶ malaria case in 2016 and applied for certification in 2020. Thailand was accepted into the WHO E-2025 initiative – an initiative for countries that have the potential to eliminate malaria by 2025 (see box text under “Thailand”, below). This places Thailand among a select group of countries that will receive specialized support and technical guidance to achieve its 2024 elimination target. In addition, Cambodia and Lao People's Democratic Republic began implementing targeted drug administration (TDA) and intermittent preventive treatment for forest goers (IPTf) to accelerate *P. falciparum* elimination in high-burden villages. These approaches continue to shift core responsibilities for tracking, testing and treatment closer to the communities affected by malaria.

All GMS countries faced community transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19). The GMS governments implemented a combination of restrictions, including public health and social measures, to limit the spread of the virus. National malaria programmes continued to adjust their procedures to safely deliver malaria services while accelerating elimination programming in active foci. Myanmar's political situation after February 2021 presented another challenge for the subregion's malaria elimination goals. The deteriorating security situation in Myanmar reduced coverage of malaria services across the country, leading to an increase in reported malaria cases in some areas. In response, Myanmar-based civil society organizations have focused on deploying intensified malaria interventions in these high-risk areas from 2022.

⁴ The data presented in this publication are based on available statistics from 14 January 2022 and have not been adjusted for late reporting or reporting incompleteness. It is expected that the 2021 malaria case, testing and death rates in the GMS may be higher than reported to the MME programme by 14 January 2022.

⁵ Cases identified with more than one *Plasmodium* species.

⁶ Indigenous cases are cases contracted locally with no evidence of importation and no direct link to transmission from an imported case.

Fig. 1

Malaria cases and testing in the GMS, 2019–2021

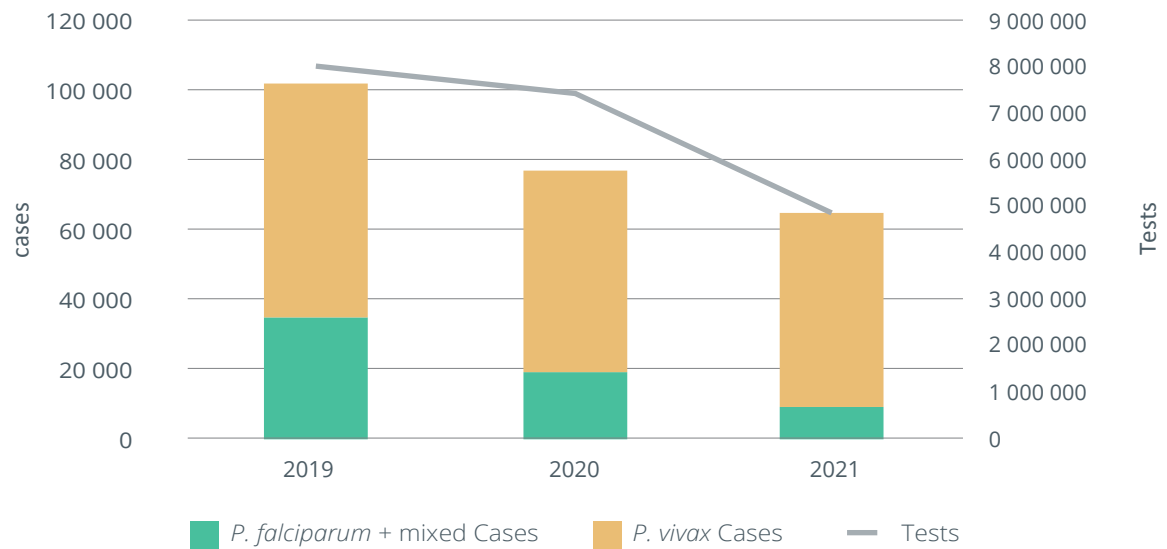
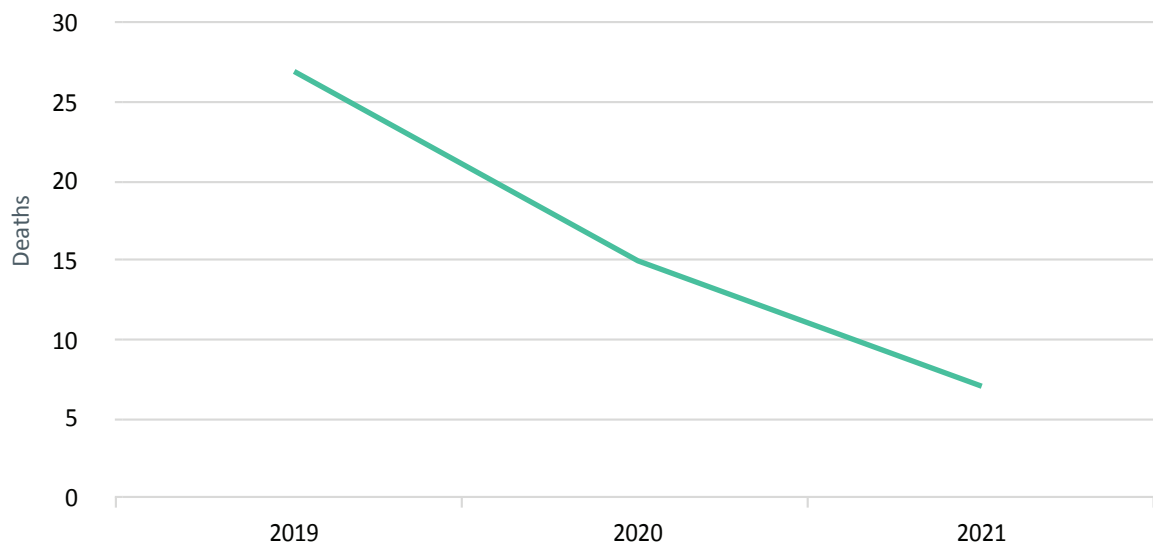


Fig. 2

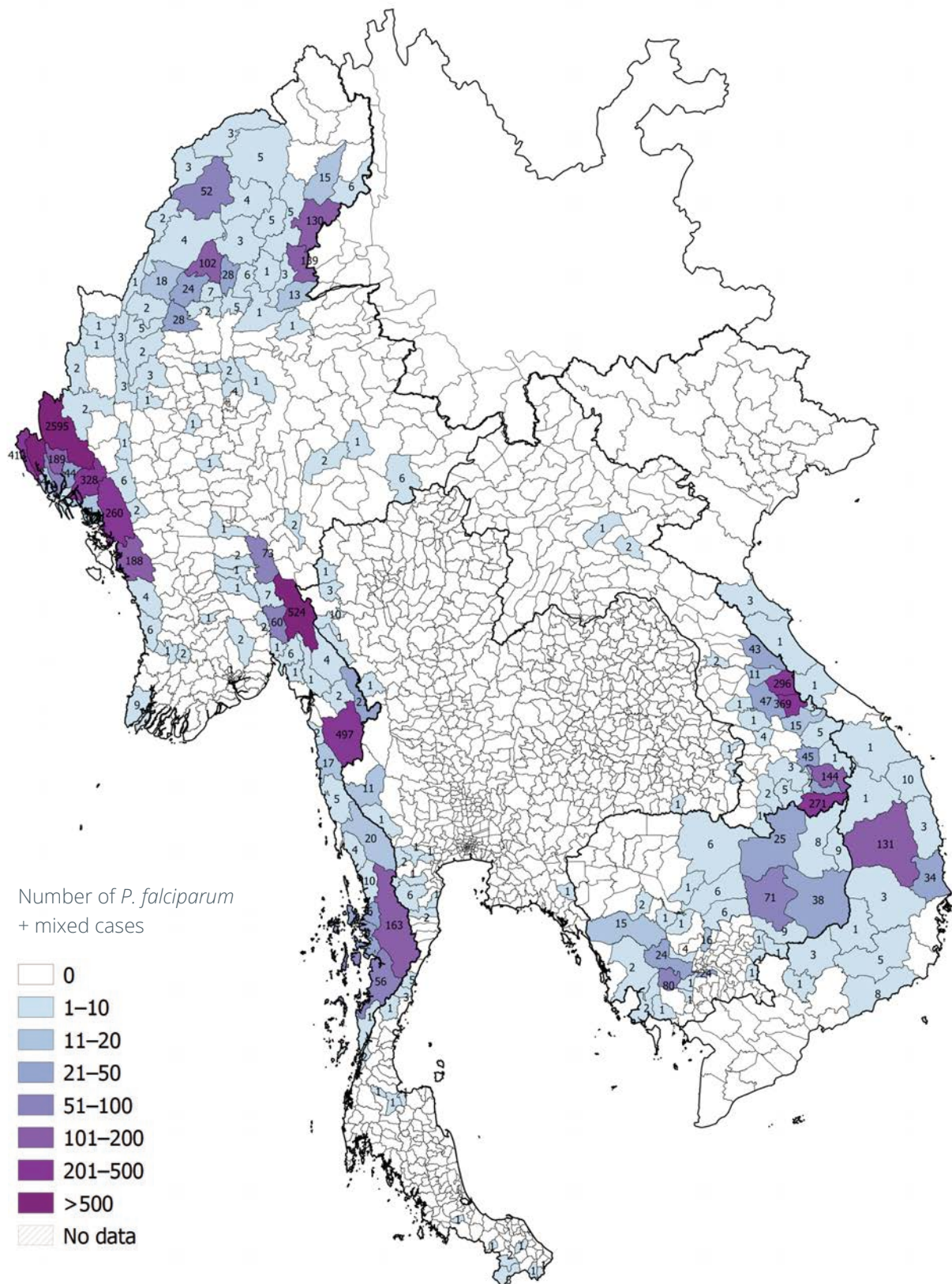
Malaria deaths in the GMS, 2019–2021



Note: Deaths from Thailand are reported annually and were not available for 2021 by the time of publication.

Fig 3.

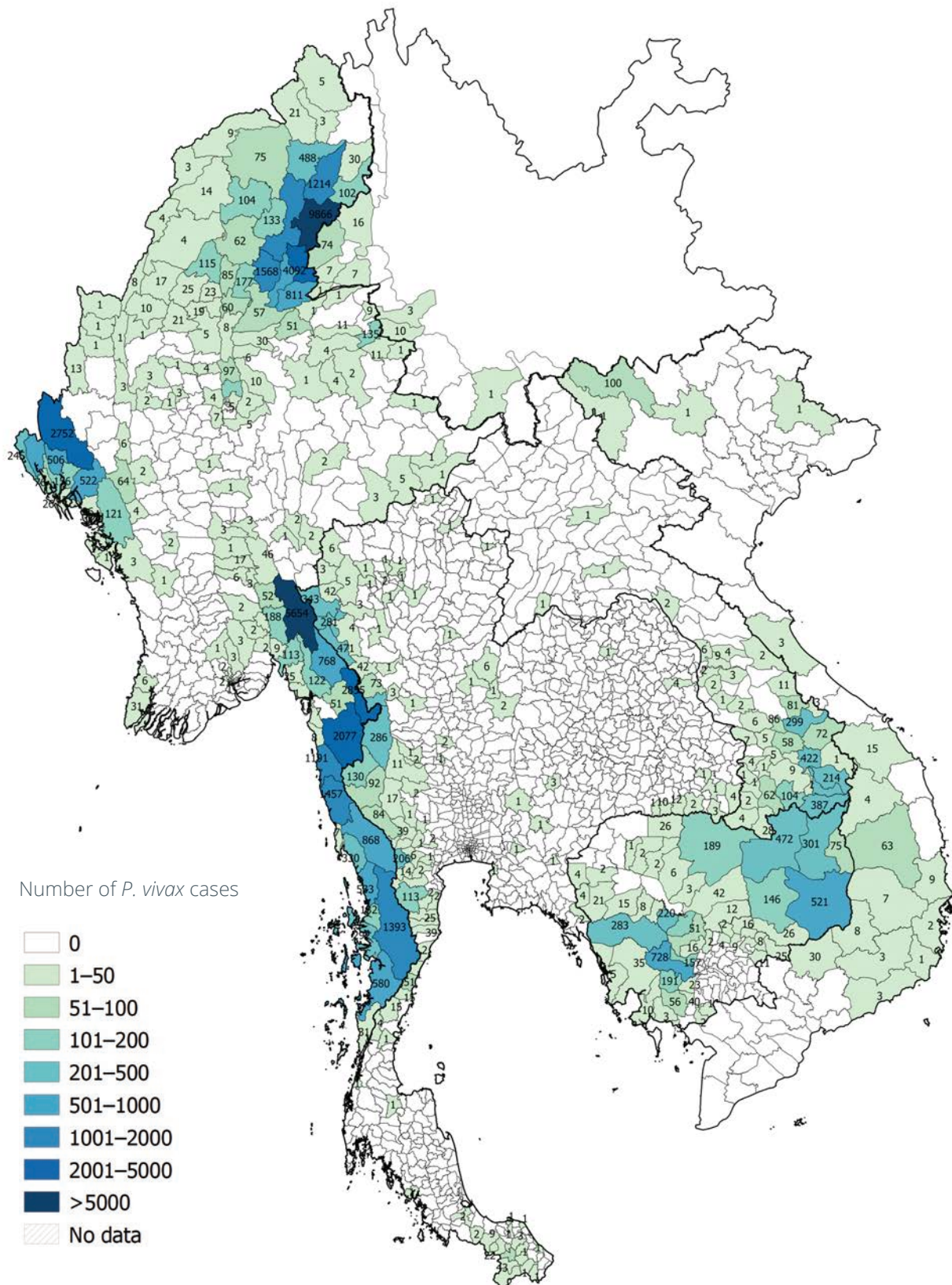
Distribution of *P. falciparum* + mixed malaria cases in the GMS in 2021



Note: Data from Viet Nam are reported at the provincial level.

Fig. 4

Distribution of *P. vivax* malaria cases in the GMS in 2021



Note: Data from Viet Nam are reported at the provincial level.



Xa Ho is a village inhabited by the La Hu hill tribe located in a remote area of Lai Chau Province in northern Viet Nam. With a large forest cover, it is considered a high-risk area for malaria. © WHO/L. Pham



Malaria surveillance systems

The *Global technical strategy for malaria 2016–2030, 2021 update* highlights the centrality of malaria surveillance, calling for its transformation into a key intervention that can improve programme planning, systematize responses, identify outbreaks and address any gaps in coverage (2). The GMS countries are increasingly focusing on adapting their malaria surveillance systems and streamlining their human resources, policies and data collection mechanisms. As many countries enter the final stages of elimination, they have worked towards integrating surveillance systems that can support case and focus investigations and responses. Cambodia, China, Lao People's Democratic Republic and Thailand all follow the 1–3–7 surveillance approach, which targets case reporting within one day, case investigation within three days, and focus investigation and response to prevent further transmission within seven days. Viet Nam uses a 2–7 approach, which requires focus investigation within 2 days and a focus response by 7 days. Myanmar uses the 1–7 approach, which requires notification within 24 hours, and case and focus investigation, classification and response within seven days.

Data sharing between countries continued to be supported during 2021 through the Malaria Elimination Database of the WHO Mekong Malaria Elimination (MME) programme, which collected aggregate malaria data across all six countries, and published updates through monthly and quarterly epidemiology summaries.⁷ The database ensures that national malaria programmes, donors and partners from the GMS can keep track of their progress while monitoring the malaria situation in neighbouring countries. The MME programme organizes annual GMS malaria surveillance conferences

⁷ Quarterly epidemiology summaries are published on the MME programme webpage: www.who.int/initiatives/mekong-malaria-elimination-programme

to review national surveillance systems, and identify challenges and practical solutions to strengthen them. The latest Annual Country Surveillance Meeting to Facilitate Malaria Elimination in the Greater Mekong Subregion was held in September 2021. National malaria programmes were encouraged to fine-tune their surveillance systems for elimination to trigger locally tailored responses to every infection in low-transmission settings, detect outbreaks, and provide robust data for strategic and operational planning. Countries were urged to take advantage of the new WHO Malaria Surveillance Assessment Toolkit to identify key actionable gaps in their respective malaria surveillance systems.

Cambodia's surveillance system classifies cases according to the probable origin of infection. Foci are classified according to their receptivity and vulnerability to malaria. Focus responses are carried out in active *P. falciparum* foci. National and subnational malaria focal points report data on case/focus classifications and investigations, tests, malaria stocks and commodities into the country's online Malaria Information System. The system generates dashboards on key priorities, including cases, testing, *P. vivax* follow-up, the status of "last mile" activities (see "Cambodia", below) and high-risk areas. This helps the national malaria programme analyse trends, forecast stocks and plan responses. Surveillance data can also be reported and viewed through a Malaria Information System mobile app.

The surveillance system in China (Yunnan Province) has integrated quick response mechanisms for all imported⁸ malaria cases. The data are collected through two web-based systems: the Chinese Information System for Disease Control and Prevention, and the Information Management System Specific to Malaria Elimination. Malaria blood tests are collected from febrile patients, and all reported malaria cases are managed using the 1–3–7 approach. In terms of vector surveillance, national vector surveillance sites and 30 provincial vector surveillance sites in Yunnan Province perform mosquito capture.

Lao People's Democratic Republic has established a sensitive surveillance system that will support elimination. The malaria information system is integrated into the national health information system, which uses District Health Information Software 2 (DHIS2). It collects monthly data on passive cases and stocks from all public health facilities, private health vendors and community health workers. The malaria information system also incorporates a "tracker" system that follows detection, investigation and response to cases and active foci in designated elimination areas. In higher-burden districts, an automated outbreak alert system in DHIS2 uses thresholds to detect and guide the programme's response activities. In 2021, the national malaria programme piloted a weekly SMS reporting system in high-burden areas to strengthen the timely detection of, and response to, outbreaks.

⁸ Imported cases are malaria cases or infections in which the infection was acquired outside the area in which it is diagnosed.

In Myanmar, all 291 endemic townships report data to the country's web-based malaria surveillance system. Cases are tracked through the complementary malaria case-based reporting and surveillance system, which is currently being upgraded and integrated into the malaria surveillance system as part of a transition to web-based reporting. A malaria case-based reporting and surveillance DHIS2 mobile app is also used by integrated community malaria volunteers in 46 townships across six states and regions. The app supports surveillance by compiling data on case management, notification, investigation and classification. Community networks, and public and private providers report into both surveillance systems.

Thailand's online malaria information system provides near real-time information to support case notification, investigation, classification and response. The case-based information system can also map foci, track data and track vector control coverage to inform resource mobilization. The system can detect outbreaks, inform patient treatment outcomes and follow up progress using integrated drug efficacy surveillance (iDES). Thailand also operates a mobile health (m-Health) app that assists district-level staff in comprehensive focus mapping and management.

Viet Nam's malaria management system collects data on case notification, case and focus investigations, focus registers, malaria stocks and commodities. Focus stratification is used to target interventions, such as distribution of long-lasting insecticidal hammock nets (LLIHs) and long-lasting insecticidal nets (LLINs) across high-burden areas.



Trieu Viet (right) has travelled with his outreach team to conduct malaria testing among Viet Nam's La Hu hill tribe. The rapid diagnostic test used on this child can provide results within 15 minutes. © WHO/L. Pham



Reaching the unreached: community malaria networks in the GMS

“Reaching the unreached” is a global health policy priority, in line with the 2030 Agenda for Sustainable Development. The policy ensures that no one is left behind by identifying “unreached” populations and the interventions needed to serve them. The people most at risk of contracting malaria in the GMS live or work in remote, forested or mountainous areas. They mainly comprise mobile and migrant populations, forest goers and ethnic minorities. In such conditions, travelling to the nearest health centre for testing can be challenging. Depleting parasite reservoirs among these populations is challenging because most asymptomatic cases are not detected by commonly used rapid diagnostic tests.

As GMS countries move towards malaria elimination, national malaria programmes have added active case detection approaches to existing passive case detection activities. These approaches decentralize core tracking, testing and treatment responsibilities from national authorities to focal points living in the communities affected by malaria. Existing networks of community malaria workers have expanded their role to cover early diagnosis, treatment and communication, to encourage effective malaria prevention behaviour among vulnerable groups. Many community malaria workers have also taken on responsibility for distributing malaria commodities, detecting malaria, reporting cases, and delivering a mixture of prevention and treatment services for their localities.

All GMS countries have integrated models of community-based health networks to accelerate malaria elimination activities and deplete parasite reservoirs in high-risk populations. In Thailand, village health volunteers work with communities, covering a large portfolio of disease programmes, including malaria. Myanmar's integrated community malaria volunteers are responsible for case management, including malaria testing, treatment and referrals. They also conduct referrals for patients suspected of having tuberculosis, HIV infection, sexually transmitted infections, leprosy, dengue or lymphatic filariasis. In Lao People's Democratic Republic, village malaria workers are trained in integrated community case management, and malaria diagnosis and treatment. They can prescribe oral rehydration salts and paracetamol, and refer patients to primary health care facilities. Cambodia's village malaria workers conduct passive testing and treatment services; mobile malaria workers are additionally tasked with active case detection in forests beyond the village borders. In active foci, village malaria workers are also responsible for focus responses. Viet Nam has deployed village health workers to support testing, and provide information, education and communication activities. Mobile teams and contact co-tracers also target workers in high-risk industries such as mining and logging.



Vu Thi Anh Tuyet (left) performs a malaria rapid diagnostic test from a La Hu villager in Lai Chau Province, Viet Nam. Vu Thi Anh Tuyet, a Senior Technician in the Department of Epidemiology, NIMPE, has 20 years of experience in screening for malaria infections in Viet Nam's malaria endemic provinces. © WHO/L. Pham



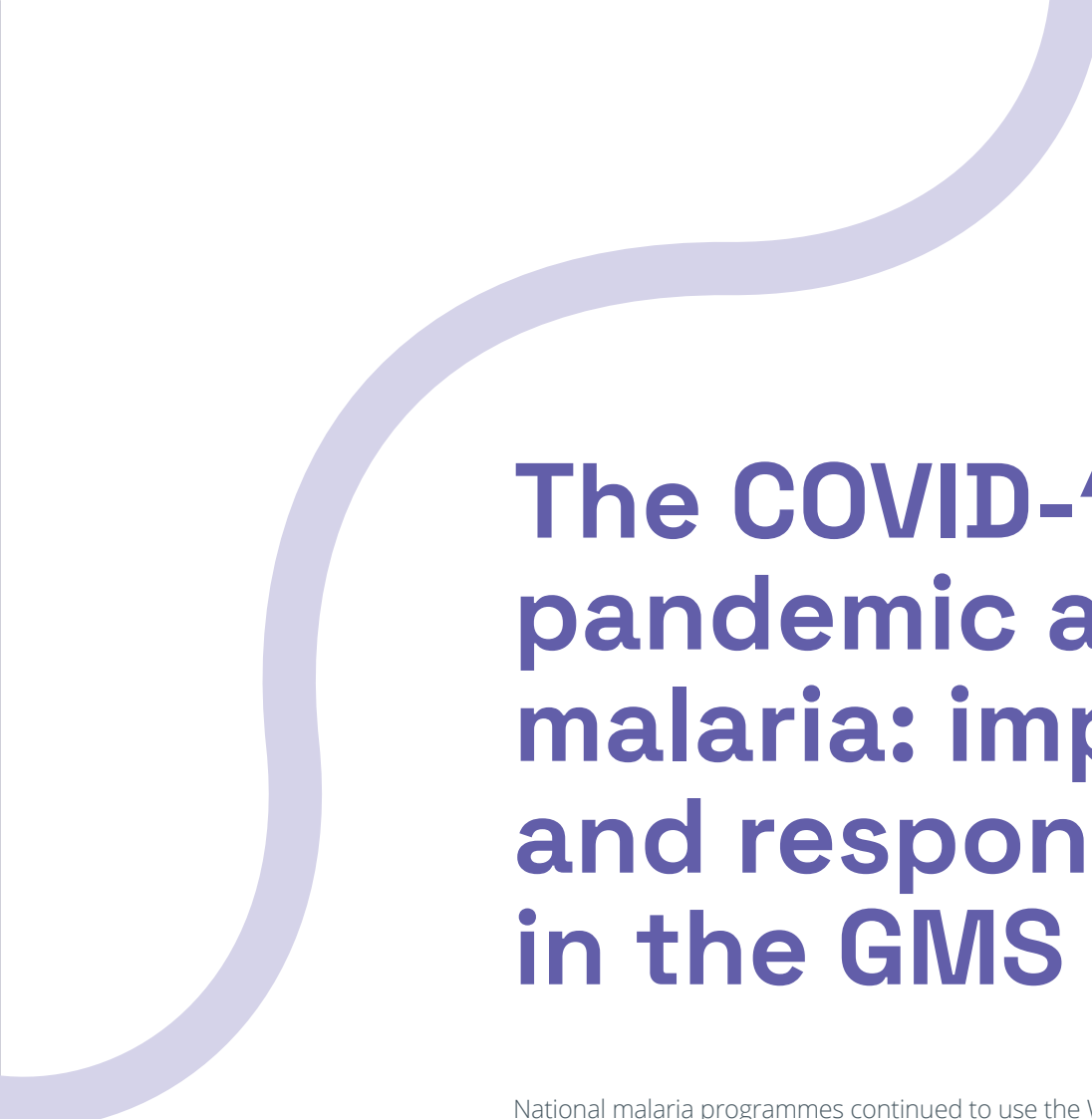
La Thanh Trung, NIMPE, sets up a mosquito trap inside a Pa U Village, Lai Chau Province, Viet Nam. © WHO/L. Pham



Rainy season in in Gao Village, Phu Yen Province, Viet Nam. Mosquito populations and malaria cases rise across the GMS during the rainy season. © WHO/L. Pham



Ly Kanha is a Cambodian midwife and health centre malaria worker. In addition to caring for new and expectant mothers, she supervises a team of village malaria workers who are tasked with finding, testing and treating all suspected malaria cases around her village in Kampong Speu, Cambodia. Malaria work in the province can be challenging because of the presence of multidrug resistance and the fact that infections predominantly come from remote forested areas. © WHO/C. Liu



The COVID-19 pandemic and malaria: impact and responses in the GMS

National malaria programmes continued to use the WHO technical guidance *Tailoring malaria interventions in the COVID-19 response* to maintain malaria service coverage in areas affected by COVID-19. At the same time, donors and partners are facilitating reprogramming. Although the GMS countries largely managed to limit the spread of COVID-19 in 2020, all GMS countries had recorded community transmission by 2021 (3). This led to governments implementing public health and social measures, including movement restrictions to prevent the spread of the virus. In 2020, the MME programme and the Independent Monitoring Panel of the Regional Artemisinin-resistance Initiative – an initiative of the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) – developed a monitoring framework to assess the COVID-19 situation in each of the GMS countries and identify potential challenges to malaria activities across the subregion. Questions under the framework assessed the impact on testing rates, routine activities, the availability of malaria stocks and personal protective equipment (PPE), and coverage of LLINs/LLIHNS. In 2021, the MME programme continued to implement the monitoring framework, and bi-weekly COVID-19 and malaria updates from national malaria programmes. The updates were used to inform WHO global workstreams to sustain malaria responses during the COVID-19 pandemic.

Cambodia's national malaria programme updated the standard operating procedures for ensuring essential malaria services during the COVID-19 pandemic. Despite the emergence of community transmission of COVID-19 in early 2021, testing rates and antimalarial stock levels remained stable. However, public health and social measures, including provincial travel bans, disrupted LLIN and LLIHN mass distribution campaigns. The national malaria programme

implemented adaptation measures to ensure that malaria services and elimination activities remained on track, and updated focus response activities according to COVID-19 regulations. Health centre staff ensured that meetings with village and mobile malaria workers continued. Participant numbers were reduced for all community-level events, and community engagement activities transitioned from village meetings to house-to-house consultations conducted by village malaria workers. Training for central-level malaria staff transitioned online, and meetings with provincial staff were decentralized and organized in their respective provinces.

China's Yunnan Province reported no indigenous malaria cases and limited numbers of COVID-19 infections in 2021. Yunnan issued *Guidance on the prevention and control of insect-borne infectious diseases in important border areas during COVID-19 pandemic*. This provides technical guidance for implementing measures against malaria importation and re-establishment during the COVID-19 pandemic. The country updated its malaria surveillance procedures in line with national efforts to limit imported malaria and COVID-19 cases. Fever surveillance was strengthened across all levels of health facilities, and patients presenting with a fever were required to transfer to township hospitals for observation and testing.

Although the 2020 public health and social measures had a limited impact on malaria activities in Lao People's Democratic Republic, the second round of nationwide movement restrictions in 2021 slightly reduced the timeliness of testing and reporting. A COVID-19 malaria risk assessment and mitigation plan was integrated into the national response plan for the pandemic in 2020. In 2021, the national malaria programme continued to monitor stocks and activities to adapt and implement the mitigation plan. With the support of the plan, the national malaria programme ensured that village malaria workers received appropriate PPE and were trained on how to use the PPE in the event of a COVID-19 outbreak. Additional antimalarial stocks were provided to health centres and village malaria workers to mitigate interruptions to supply chains. Information and education messages were also developed and launched in malaria-endemic communities. The messages highlighted the importance of continuing to access health care services, particularly for patients presenting with a fever.

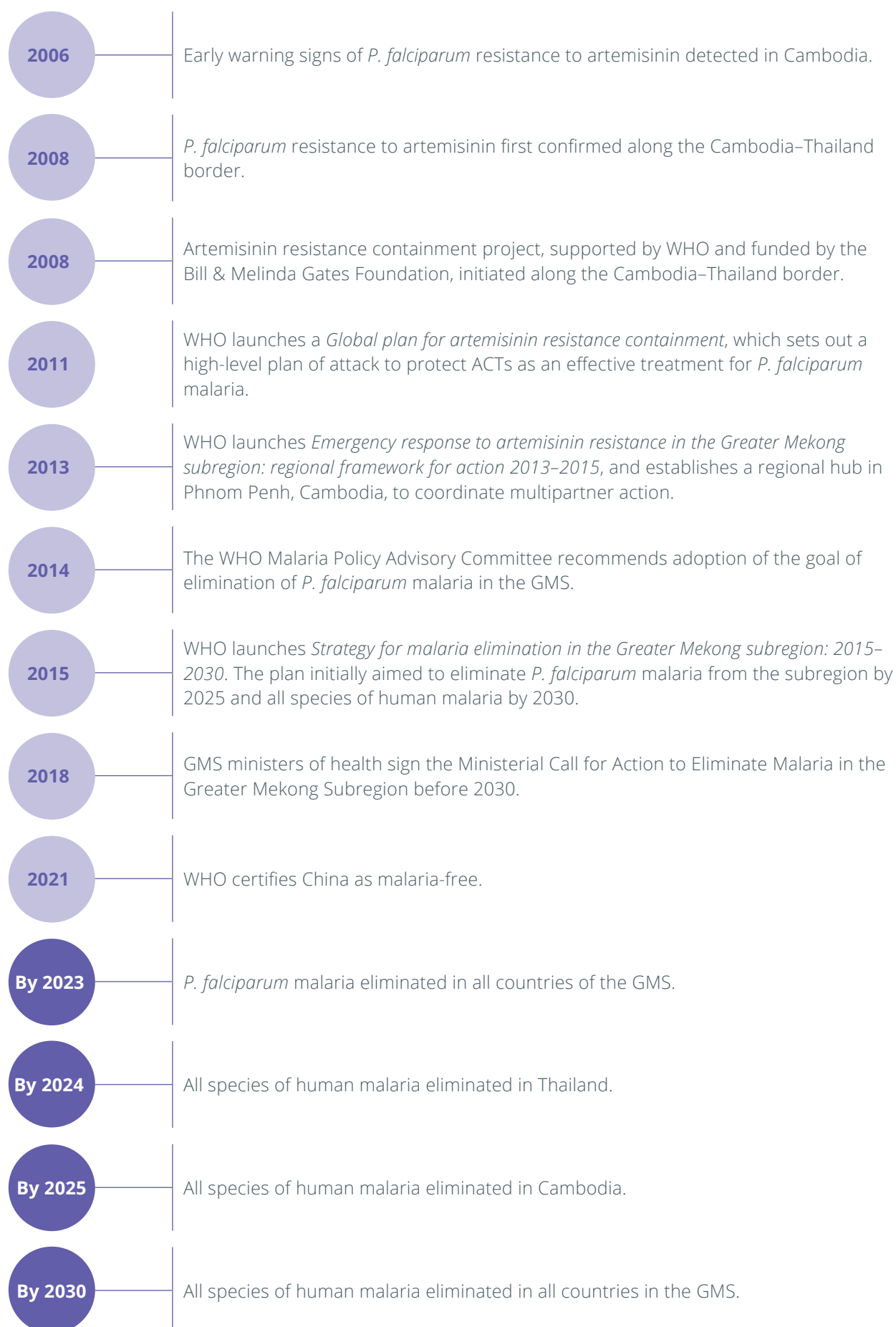
Myanmar developed guidelines in 2020 that outlined the country's approach to maintaining malaria activities during the COVID-19 pandemic. In 2021, WHO and partners continued to implement the guidelines in the context of fragile security, recurring waves of COVID-19 cases and rising malaria in some parts of country. WHO, partners and Myanmar's National Malaria Control Programme regularly conducted programme criticality exercises to plan activities, taking into account both the pandemic and the evolving security situation. Donors released funds to maintain community-level malaria activities by providing PPE to health workers and integrated malaria community volunteers. Testing rates fell as testing and treatment services from public health facilities were constrained after February 2021. Despite this, integrated malaria community volunteers continued to offer testing and treatment services, and WHO and partners performed logistical analyses to avoid stockouts. After February 2021, donors facilitated the distribution of malaria commodities to states, regions and partners to ensure coverage for at least 6 months. However, problems in supply chain logistics led to disruptions in the provision of drugs, tests and LLINs to communities. To adhere to safety and security measures, meetings, workshops and training were delivered virtually.

Thailand implemented COVID-19-related public movement restrictions from early 2021. Malaria testing rates decreased during the periods of movement restrictions, but this was likely linked to reduced exposure and movement among at-risk populations, which resulted in lower numbers of symptomatic cases. Since March 2021, meetings and supervision visits were postponed or changed to virtual events. Public movement restrictions in malaria-endemic villages led to temporary disruptions to elimination activities, including focus responses under the 1–3–7 surveillance strategy. Some malaria staff were reassigned to the COVID-19 response. The national malaria programme mitigated the activity disruptions by redistributing stocks of antimalarials and LLINs/LLIHNS to village health volunteers. This ensured that community workers had better access to the commodities required for vector control, testing and treatment. As in other countries across the GMS, donors released funds to provide PPE to frontline workers, including teams based in health facilities and villages, and those responsible for indoor spraying with residual insecticides.

Viet Nam implemented nationwide COVID-19-related public movement restrictions and travel bans in 2021. Malaria testing rates decreased during these periods because malaria teams could not travel to communities to perform active case detection. Movement restrictions also limited routine field-based malaria surveillance, monitoring and evaluation activities. Field visits resumed once provincial travel bans were lifted. At the provincial level, provincial centres for disease control took on the responsibility for procuring PPE for frontline workers. This ensured that community-level workers could continue most of their routine malaria activities. Training activities were affected, but were promptly delivered virtually rather than physically. Although stocks of antimalarial drugs and commodities were adequate throughout the year, the national malaria programme faced supply chain logistic challenges. This led to delays in distributing commodities in provinces and malaria-endemic districts.

In 2022, national malaria programmes, WHO and partners will continue monitoring the impact of the COVID-19 pandemic on malaria activities across the GMS. The updates will be used to formulate strategic recommendations, secure the supply of malaria commodities and drugs in the GMS, and maintain a dialogue that emphasizes ways to sustain malaria elimination.

GMS MALARIA ELIMINATION TIMELINE AND KEY TARGETS





Proactive case detection in Mae Hong Son Province, Thailand. © K. Somchart, Vector Borne Disease Control Unit 1.1 Mae Hong Son.



Paen Narin holds artesunate mefloquine, the chosen antimalarial medication for TDA and IPTf in Cambodia. Narin is a village malaria worker and farmer who is responsible for delivering malaria services to 28 households in Luon Thmey village, Stung Treng Province, Cambodia. © WHO/A. Raab

A young man with dark hair, wearing a bright blue long-sleeved button-down shirt, is standing in a lush green forest. He is holding the corners of a large, translucent green mesh net, which is being hung between two trees. The net is partially inflated and draped over the branches. The background is filled with dense tropical foliage and tall trees, with sunlight filtering through the leaves. A thick, wavy purple line runs diagonally across the upper right portion of the image.

Malaria situation in the Greater Mekong countries

A forest goer sets up his long-lasting insecticidal hammock net. Tailored vector control measures, including hammock nets, are used across the GMS to protect at-risk populations, such as people who regularly sleep in forests. © WHO/A. Raab

● CAMBODIA

Cambodia reported 4329 cases of malaria in 2021, a 54% reduction compared with 2020. Men are at greatest risk of contracting malaria and account for 81% of all infections. There were 361 *P. falciparum* + mixed cases in 2021, which represents a 65% decline from the previous year. This progress aligns with the targets in Cambodia's *Malaria elimination action framework (2021–2025)*, which envisages the elimination of *P. falciparum* malaria by 2023 and all species of human malaria by 2025. Malaria testing remained steady, with 818 729 tests performed in 2021, a 4% decrease from 2020. The test positivity rate was 0.53%. Cambodia has not recorded any malaria deaths since 2018. The National Center for Parasitology, Entomology and Malaria Control (CNM) continues to transform malaria surveillance into a core intervention. The elimination surveillance manual was revised in 2021, providing the strategic framework required for malaria elimination.

Cambodia launched a *Malaria intensification plan for hard to reach populations* in 2018 to implement interventions to reduce the malaria burden through increased passive and active case detection. Malaria activities were intensified, based on monthly epidemiological analyses and hotspot mapping. Additional village malaria workers were deployed in hotspot areas, and mobile malaria workers were assigned to high-risk forested areas to ensure early case detection and treatment. Elimination activities began in early 2020 to detect, investigate and clear *P. falciparum* + mixed cases and foci. In November 2020, the CNM, WHO and partners launched the “last mile” of malaria elimination to intensify focus responses and accelerate *P. falciparum* elimination. The last mile covers a package of focalized innovative approaches, including TDA and IPTf, community engagement, vector control, and weekly active fever screening in active foci across five provinces. From early 2021, elimination activities were deployed for all cases and foci in the country.

Village malaria workers and mobile malaria workers have played a central role under the last mile activities. In 2021, they were responsible for 80% of all malaria testing. With declining cases, the Ministry of Health developed a roadmap to integrate village and mobile malaria workers into other community health networks. The roadmap will sustain the village malaria worker model and support control and prevention of other infectious diseases. The integrated package aims to have village malaria workers covering disease prevention and education for other vector-borne diseases. It would include identification and referral services for dengue, chikungunya, schistosomiasis, neglected tropical diseases and foodborne illnesses.

The *P. vivax* radical cure and glucose-6-phosphate dehydrogenase (G6PD) testing were expanded to 324 health facilities across the country. G6PD testing aims to identify people with a deficiency in this enzyme, which can lead to haemolytic anaemia in people who take primaquine to treat relapses of *P. vivax* malaria (4). Referral rates from village malaria workers for G6PD testing increased from 20% in February 2021 to 43% by November 2021. Discussions are ongoing to ensure the safest and most effective treatment to prevent *P. vivax* relapse, guided by testing for G6PD status. The CNM placed further emphasis on the quality assurance of diagnosis by delivering regular outreach, supervision and on-site training for the nationwide network of microscopists. The Royal Government of Cambodia also completed a sustainability assessment of the malaria programme and increased its financial contribution towards malaria activities.

In 2022, the CNM will continue to implement elimination activities with the support of WHO and partners. The country will continue to monitor antimalarial drugs by completing therapeutic efficacy studies (TES), as well as establishing and expanding iDES. Quality assurance of diagnosis will be enhanced by establishing a national reference laboratory and provincial quality assurance laboratories. The laboratories will hold regular quality assurance activities, and undertake external competence assessment and national competence assessment of malaria microscopy. Lastly, the CNM will expand G6PD testing and treatment of all *P. vivax* cases with primaquine to prevent relapses.

● CHINA (YUNNAN PROVINCE)

China has reported no indigenous malaria cases since 2017 and was awarded a malaria-free certification by WHO in 2021. From January to October 2021, there were 122 imported malaria cases in Yunnan Province, mainly from Myanmar. The testing positivity rate was 0.1%, and 111 423 tests were conducted in Yunnan during this period. Focus classification from 2021 in Yunnan recorded no active foci, although there were an estimated 63 foci with potential transmission.

The Chinese Center for Disease Control and Prevention continued to maintain a sensitive and efficient malaria surveillance system by strictly implementing the 1–3–7 approach, delivering surveillance training and conducting laboratory quality control exercises. With support from Yunnan's medical institutions, the Yunnan Provincial Center for Disease Control and Prevention monitored and reported all malaria cases. In addition to antimalarial drug efficacy surveillance of all *P. falciparum* and some *P. vivax* cases, the Yunnan Institute of Parasitic Diseases focused on preventing malaria transmission in border areas, particularly in townships that neighbour Myanmar. Teams of experts visited border areas to provide on-site guidance on implementing policy measures and technical protocols to prevent the import and re-establishment of malaria. Key border counties, townships and villages implemented targeted measures, including vector control, to prevent transmission in high-risk areas. The activities were supported by ongoing capacity-building activities, which focused on practical techniques to prevent re-establishment of imported malaria in border areas.

CHINA BECOMES THE FIRST MALARIA-FREE COUNTRY IN THE GMS

CHINA'S PATH TO CERTIFICATION AND THE NEXT STEPS TO PREVENT RE-ESTABLISHMENT

In June 2021, WHO officially certified China as malaria-free. This makes it the first country in the GMS to achieve this status. Following the launch of the national elimination action plan in 2010, China began to align its programming documentation methods with those required for WHO certification (5). The National Health Commission organized a subnational verification process, and 24 formerly endemic provinces were verified as malaria-free. The provincial verification mirrored the steps that would need to be followed for the WHO certification process for malaria elimination. When gaps were identified, the National Health Commission took action to improve the capacity of the national malaria programme to prevent re-establishment. A national expert committee for malaria elimination was established to support the provincial verifications. Lastly, the National Health Commission established a working group with senior malariologists to prepare the national elimination report. These steps enabled the Government to submit the official certification request to WHO in November 2020. Following this, the WHO Malaria Elimination Certification Panel conducted an independent evaluation mission in May 2021. All members of the panel recommended the malaria-free certification for China.

China is now focusing on implementing the interventions to maintain its malaria-free status. In 2020, 13 ministries, including the National Health Commission, and ministries of education, finance, customs, and culture and tourism, jointly issued *Administrative management for the prevention of re-establishment of malaria transmission*. This official document reiterates the political commitment to maintain a malaria-free status by providing the necessary financial and human resources to sustain essential malaria activities. The Chinese Center for Disease Control and Prevention also recently published the *Technical strategy for the prevention of re-establishment of malaria transmission* to provide technical guidance for prevention.

30 JUNE 2021

● LAO PEOPLE'S DEMOCRATIC REPUBLIC

Lao People's Democratic Republic recorded 3896 cases of malaria in 2021, of which 49 were imported. Malaria cases increased by 11% compared with 2020. This was caused by a spike in *P. vivax* cases, which rose from 1916 cases in 2020 to 2545 cases in 2021. In 2021, the test positivity rate was 0.6%, and 641 594 tests were performed. This represented an 11% growth in testing from 2020. The country recorded one malaria death, the first since 2019. The Center for Malaria, Parasitology, and Entomology (CMPE) recently launched the new *National malaria strategic plan*, covering the period 2021–2025.

The populations driving *P. falciparum* transmission in Lao People's Democratic Republic can be broadly categorized into four high-risk groups.⁹ These categories have been determined through epidemiological profiling, which considers heterogeneous patterns of behaviour and the exposure risk of people in the highest transmission areas.

1. FOREST GOERS:

Typically young men who travel deep into the forest for 1–2 weeks (often in groups) to collect seasonal forest commodities that can be sold. In 2021, 64% of all cases were male.

2. FIELD GOERS:

Whole families, or family members, that spend short seasonal periods (1–14 nights) living in small huts on cultivation fields. These are often located inside or on forest fringes.

3. SATELLITE (KATO) VILLAGE POPULATIONS

small, remote informal satellite settlements (2–4 basic houses) that are located inside the forest and a long distance from the formal (residential) village. Families spend extended periods (2–6 months) living in these settlements to cultivate crops, tend livestock and hunt in the forest.

4. FOREST VILLAGE POPULATIONS:

Villages located within or on the margins of the forest.

In June 2021, the CMPE, the Ministry of Health, WHO and partners launched “accelerator strategies” for high-burden villages where core malaria interventions are having a limited impact. Under this programme, targeted villages receive a combination of vector control measures, intensified early case detection, TDA and IPTf. The initial pilot was launched in Khammouane Province and will expand to four further provinces in 2022.

Improving outbreak detection continues to be a priority of the CMPE. With malaria recently designated as a notifiable disease, the CMPE is working to improve reporting timeliness so that cases can be reported to the national early warning disease system every week. In 2021, 29 high-burden health facility catchments were selected to participate in a large-

⁹ Villages often include more than one risk group, and individuals may fit into more than one risk group.

scale pilot of the weekly SMS reporting system. The regular reporting shows positive results and demonstrates how rapid, data-driven and action-oriented approaches to passive case detection can interrupt transmission. In 2021, malaria staff used the weekly reports to successfully identify and prevent outbreaks in Xepone and Nong districts in Savannakhet Province.

In 2021, the CMPE started hosting routine weekly management meetings to regularly monitor, evaluate and provide feedback on the programme's performance at all levels. These meetings use a standard framework for an emergency operations centre, allowing more proactive approaches to malaria programme management. Through this structure, central-level malaria managers work closely with provincial- and district-level staff to identify issues or gaps in implementation and build their capacity to resolve problems with malaria elimination.

The biggest hurdles faced by the malaria programme concern the efforts needed from local, provincial and central malaria staff to adopt more elimination-focused strategies. This requires addressing the existing gaps in data collection, surveillance and outbreak responses at the subnational level. As part of the commitment to improve data use, WHO and the Clinton Health Access Initiative supported the placement of technical advisers in the country's highest-burden provinces. The advisers work with provincial and district malaria staff to improve malaria surveillance and increase the competence of the staff to use DHIS2 dashboards. In 2021, emphasis was placed on building the skills of subnational teams to extract and analyse data, and use the data to identify and address critical programmatic issues related to elimination, outbreak responses, case management, reporting and logistics.

In 2022, the CMPE will continue rolling out the accelerator strategies and enhancing the existing malaria surveillance systems. The malaria information system will be further improved by integrating complete village-level case data, an elimination tracker, stock monitoring and routine passive case detection event databases into the DHIS2. Mass distributions of LLINs are planned for 2022, and the CMPE and partners will ensure that nets are distributed to the highest-risk populations. This will be complemented by routine distributions of LLINs. WHO, partners and the national malaria programme will focus on using epidemiological data to ensure that these protective tools are provided to the right people (forest and field goers) at the right time (before high-transmission periods) in the right locations (areas that are prone to outbreaks that are driven by forest and field goers). The CMPE will also continue monitoring the efficacy of first-line antimalarial treatments. This is particularly important considering the stagnating number of cases in some focalized areas, and how prone these areas continue to be to outbreaks and seasonal epidemic fluctuations. The TES planned for Savannakhet, Sekong and Attapue will help the programme identify the presence of any drug resistance and whether revisions are needed in the national malaria treatment guidelines.

● MYANMAR

From January to November 2021, Myanmar recorded 53 314 cases of malaria, a 3% decrease compared with the same period in 2020.¹⁰ Of these, 7322 were *P. falciparum* + mixed cases, a 49% decrease from the same period in 2020. Conversely, *P. vivax* cases increased by 13%. The test positivity rate was 3.9%. Health providers tested 1 351 326 suspected cases, a 60% decline compared with 2020. Six deaths were reported by December 2021. WHO continues to support the National Malaria Control Programme (NMCP) to implement the *National strategic plan for malaria elimination (2021–2025)*. The plan aims to intensify malaria activities in high-burden hotspots, which account for more than 80% of the country's cases.

Myanmar's malaria programming response in 2021 was affected by the political crisis that emerged after February 2021. The situation resulted in security, access and logistical constraints, which reduced the coverage of malaria activities. As a result of the breakdown of the public health system, private and civil society health providers took on more responsibility for core malaria services. The NMCP, WHO and partners conducted programme criticality exercises to maintain essential malaria services such as testing, treatment, tracking and distribution of LLINs through integrated community malaria volunteers. In 2020, Myanmar had a network of 23 000 integrated community malaria volunteers, almost 70% of whom continued working in 2021. Malaria elimination activities, including case and focus investigations, classification and responses, continued at a lower level than previously in 262 townships. Supervision, monitoring, meetings, workshops and training were delivered remotely. The NMCP continued to improve the malaria surveillance system by enhancing dashboards and accessibility to all administrative levels. First- and second-line ACTs remained effective, and primary vectors were still susceptible to pyrethroids.

The main challenges for malaria programming related to difficulties reaching high-risk populations in endemic areas due to COVID-19 travel restrictions and heightened security concerns. These problem also affected the timeliness of case reporting from certain regions. There was an unusual seasonal transmission of *P. vivax* malaria, and the NMCP, WHO and partners responded to *P. vivax* outbreaks in the northern and southern parts of the country. The outbreaks primarily occurred in forested areas and plantation sites. Delayed outbreak reporting, as well as stockouts of antimalarials, were the key factors driving increased transmission in these areas. The outbreaks were exacerbated by delayed responses linked to the ongoing movement restrictions.

Myanmar continues to engage in regional meetings to address malaria transmission in border areas. Cases decreased near Myanmar's borders, but the decrease may be partly due to incomplete reporting since February 2021. China has continued to support Myanmar in managing malaria along its shared border by constructing three state laboratories to support

¹⁰ Myanmar's statistics were affected by reporting delays. It is expected that the actual case and testing numbers for 2021 will be higher than reported to this bulletin on 14 January 2022.

intensive malaria control and elimination in Kachin State, and northern and eastern Shan State. The laboratories will service 23 border townships. The Global Fund's COVID-19 Response Mechanism also covered the provision of malaria commodities to integrated health service centres along the Myanmar–Thailand border.

In 2022, Myanmar will build up malaria services and surveillance through the existing network of partners and integrated community malaria volunteers. Integrated community malaria volunteers will have new roles in conducting more proactive case detection and weekly house-to-house visits. Myanmar will optimize its intensified response plans to ensure full coverage of malaria services in hotspot areas and accelerate *P. falciparum* elimination through drug-based accelerator strategies, where applicable. The country will establish a malaria elimination pilot site in one township. The NMCP, WHO and partners will also focus on strengthening activities to support outbreak prevention, detection and control in high- and moderate-transmission areas. Capacity-building will be aimed at improving the collection of elimination data for the malaria case-based reporting and surveillance system.



Four-year-old Phyu Phyu Thet Thun holds a booklet with information on malaria prevention in Paik Kyee Wei Village, Yangon, Myanmar. © WHO/ V. Sokhin

● THAILAND

Thailand reported 3177 malaria cases in 2021, a 21% decrease from 2020. Of these, 796 were imported cases. The country recorded a record low number of *P. falciparum* + mixed cases. There were only 70 *P. falciparum* + mixed cases in 2021, a 67% reduction from 2020. With steady reductions in cases, crude testing rates declined by 20%, and the test positivity rate was 0.5%. Men constituted 69% of all cases. The Division of Vector Borne Diseases (DVBD) has conducted annual elimination validation exercises at the subnational level since 2018. In 2021, the DVBD assessed 42 of 77 provinces and validated 37 as malaria-free (three provinces have since reported reintroduction and two re-establishment of malaria). This places Thailand on track for the 2024 malaria elimination goal. Malaria-free validation tools and checklists were recently updated using the WHO's resources on prevention of re-establishment (5). The DVBD is implementing the *National malaria elimination operational plan (2021–25)* and recently revised its programmatic documents to prepare for the upcoming elimination target, including *National malaria treatment guidelines*, *Prevention of reintroduction guidelines* and *Malaria elimination validation manual*.

Malaria elimination policies continue to be mainstreamed into the general health system. *P. falciparum* focus investigations and iDES are fully implemented across the country. The national reference laboratory recently launched a standardized malaria microscopy training curriculum to maintain the quality of microscopy readings. Thailand is establishing a national laboratory database linked to the malaria information system. Health staff continue to use the mobile health (m-Health) app to guide and track malaria elimination, including focus management. The app is integrated into the national malaria information system and allows staff to map cases down to the household level, monitor field progress and monitor intervention coverage. The DVBD continues to intensify efforts to interrupt transmission. In line with this, 540 village health volunteers in malaria-endemic villages recently received comprehensive malaria elimination training on supervised treatments, patient follow-up, case detection and behaviour change communication.

In 2022, the DVBD will place greater emphasis on building up systems capable of preventing the reintroduction of malaria, eliminating *P. falciparum* and improving the quality of the 1–3–7 surveillance strategy. Epidemiological data indicate that five more provinces will be eligible for national malaria-free validation in 2022. Local administrative organizations will continue to increase their annual budgets for malaria, an essential step in building sustainable subnational financing models. With a plan for prevention of reintroduction nearing finalization, the DVBD launched a pilot plan in two provinces in December 2021.

THE E-2025 AND THAILAND

Thailand was recently selected for inclusion in the WHO E-2025, an initiative for countries that have the potential to eliminate malaria by 2025. As a result, Thailand, with support from WHO and partners, is expected to participate in regular elimination forums, conduct periodic surveillance assessments and publicly share malaria case data. In addition, the country must audit its elimination programme annually using the WHO Malaria Elimination Audit Tool. The audit exercises are submitted to the Malaria Elimination Oversight Committee, which provides tailored recommendations to improve the DVBD's readiness for certification.

● VIET NAM

Malaria cases continue to decline in Viet Nam. There were 459 cases in 2021, of which 52 were imported. This was a 68% reduction from 2020. Men were most at risk of contracting malaria; 78% of all cases were among males, primarily between the ages of 25 and 49. The country recorded 206 *P. falciparum* + mixed cases, a 75% decrease from 2020. Malaria testing decreased by 27%, and the country did not record any malaria deaths. The National Institute of Malariology, Parasitology, and Entomology (NIMPE) has certified 35 out of 63 provinces as malaria-free.

Viet Nam is now implementing the five-year *National strategy for malaria elimination (2021–2025)*. The plan reinforces the country's vision to reach malaria-free status by 2030. The NIMPE and Institute of Malariology, Parasitology, and Entomology (IMPE) will achieve this by deploying core interventions across malaria-endemic districts, monitoring drug resistance and preventing reintroduction in malaria-free areas. During the past year, the NIMPE's efforts have focused on active and passive case detection, LLIN distributions, early diagnosis and treatment, and behaviour change communication activities. Case-based surveillance is implemented according to the country's 2–7 approach. Revised surveillance guidelines will be launched in 2022, covering updated protocols for case notification, investigation, focus investigation and response.

Although malaria cases and deaths have been steadily declining, antimalarial drug resistance remains an ongoing concern. Partial artemisinin resistance has been detected in *P. falciparum* malaria cases in Binh Phuoc, Dak Nong, Gia Lai and Dak Lak provinces. The NIMPE started rolling out iDES surveillance in 2018 to monitor patient treatment outcomes and the efficacy of antimalarial drugs. Surveillance of drug efficacy continues to be reinforced by training for technical staff on diagnosis and case follow-up protocols. In 2021, TES were completed in Binh Phuoc, Gia Lai and Phu Yen provinces for artesunate–pyronaridine (*P. falciparum* cases) and chloroquine (*P. vivax* cases).

Viet Nam is currently implementing a range of operational research projects to manage *P. vivax* foci and reservoirs. These include a study on the feasibility of point-of-care G6PD testing among *P. vivax* cases. Based on the study's findings, the NIMPE will scale up G6PD testing to deliver the radical cure treatment for all *P. vivax* cases. This aligns with the 2020 national treatment guidelines, which stipulate that G6PD testing is required for all *P. vivax* patients who receive primaquine (if the test is available).

Challenges remain in sustaining the financial resources for malaria elimination. During the past 5 years, provincial malaria centres and other preventive health centres were merged and transformed into provincial centres for disease control and prevention. This action has led to a sharp decrease in provincial resources for malaria. In the coming year, increased emphasis is needed on securing sustainable funding sources to maintain full coverage of malaria elimination activities.

Fig. 5

Changes in *P. falciparum* + mixed cases in the GMS countries from 2020 to 2021

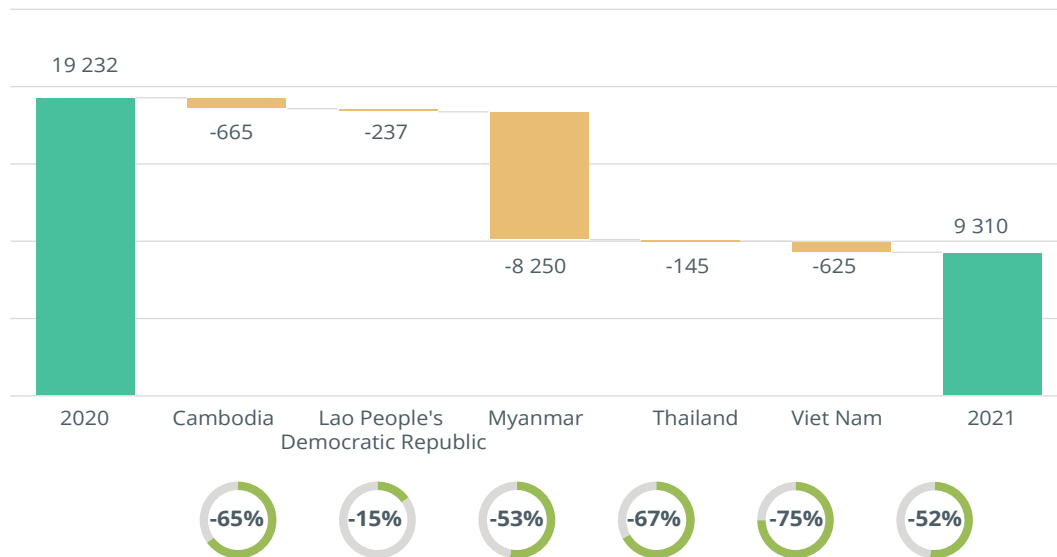
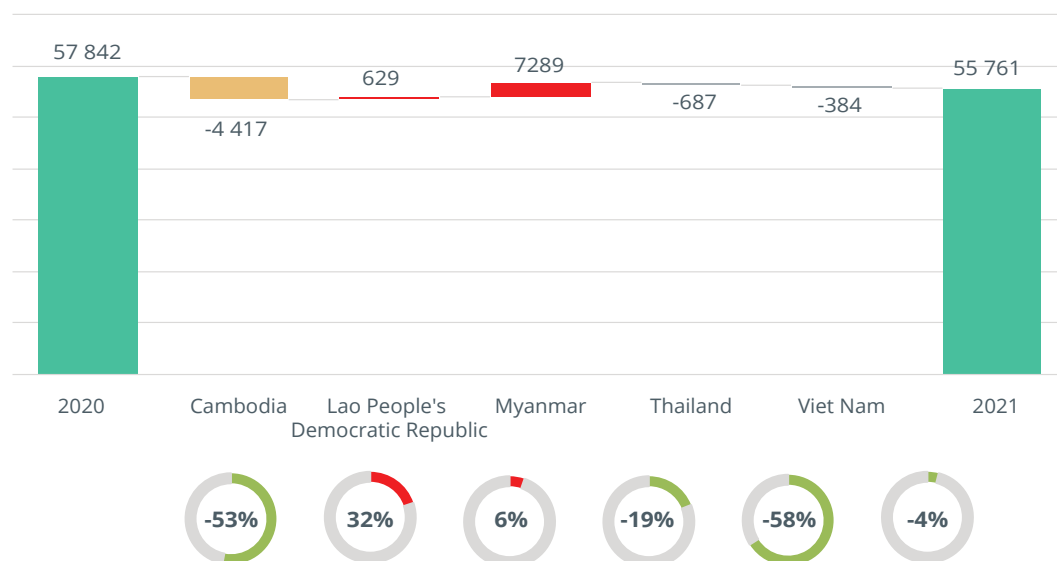


Fig. 6

Changes in *P. vivax* cases in the GMS countries from 2020 to 2021





Paen Narin (left) is a village malaria worker and farmer from Luon Thmey village, in Stung Treng, Cambodia. His colleague Pok Thiem (right) is a schoolteacher as well as a village malaria worker. Both men are responsible for around 30 households and provide malaria elimination activities, including testing, fever screening, community engagement, net distribution, treatment and preventive drug administration for their community. © WHO/A. Raab



Accelerator strategies and focalized innovative approaches

With lower malaria caseloads, national malaria programmes continued to implement case- and focus-based surveillance systems and interventions to eliminate malaria. Cambodia and Lao People's Democratic Republic also launched accelerator strategies and focalized innovative approaches (TDA and IPTf for at-risk populations). The strategies were designed with WHO (MME programme and country offices) and partners according to epidemiological and local contexts. They are implemented together with community engagement, intensified case management and vector control measures.¹¹

Cambodia's CNM, WHO and partners launched the “last mile” of malaria elimination in November 2020 to intensify responses in foci. The last mile activities are implemented from door to door by full-time village malaria workers and cover approximately 80 active foci in five provinces. Community engagement and social mobilization strategies are used to raise awareness of the last mile activities and maintain high levels of coverage among the target population. Census data define the target populations for TDA and IPTf, and for LLIN and LLIHN top-up distributions. The purpose of TDA is to deplete parasite reservoirs in active foci. TDA covers two rounds of antimalarial medication (artesunate–mefloquine), given at one-month intervals to all men aged 15–49. IPTf (artesunate–mefloquine) is provided throughout the year to eligible men aged 15–49 who plan to go to high-risk malaria areas (typically forests) in the following month. Village malaria workers conduct

¹¹ WHO epidemiologists, WHO staff and United Nations volunteers have been deployed to targeted hotspots to support national malaria programmes, partners and local authorities with rolling out the focalized innovative approaches.

active fever screening in the whole village on a weekly basis. People with malaria symptoms are tested for malaria and treated if they are positive. By the end of 2021, last mile activities had been launched in 56 active foci. Among these foci, TDA coverage reached 56% in the first round and 48% in the second round. The refusal rates for each round were 4% and 12%, respectively. Concern about the potential side effects of artesunate–mefloquine was cited as the main reason for men to refuse TDA in the second round. Although IPTf uptake varied by month based on the number of men going to high-risk areas, the average coverage was 20%.¹² IPTf uptake increased over time as it became routine. A preliminary assessment of the last mile activities indicated that ongoing community engagement has been critical in raising awareness, encouraging uptake of TDA and IPTf, and increasing malaria testing. The active inclusion of local authorities and village-level leaders is another factor driving community participation in the activities.

In 2021, Lao People's Democratic Republic piloted “accelerator strategies” to target high-burden areas where residual *P. falciparum* transmission continues to be a problem. A pilot covering 200 households in five villages began in July 2021 in Khammouane Province. After households complete a household census, health centre staff and village malaria workers conduct community engagement activities and top up LLINs. Anyone spending nights in forests receives an LLIN. Two rounds of TDA (artesunate–mefloquine) are provided at 1-month intervals to anyone aged 7–49. Three rounds of IPTf are given to anyone aged 7–49 who sleeps in forests. Village malaria workers visit houses every two weeks to conduct active fever screening and test individuals with a fever. Initial findings from the pilot indicate that the reported side effects of artesunate–mefloquine had a negative impact on the coverage of TDA. As a result, the CMPE recently switched to artesunate–pyronaridine. The accelerator strategies will be launched across selected villages in four more provinces by early 2022. The CMPE, WHO and partners will continue to assess the impact of these interventions, and gather further evidence on behaviour profiles and exposure risks in areas with residual transmission. Information from this work will be critical in identifying gaps in the current interventions, and tools and strategies that can effectively protect and service these populations.

¹² The coverage is estimated by comparing individuals who took IPTf with the targets from the village census. This may not reflect the actual coverage because not all IPTf targets visit high-risk areas every month. Men who do not intend to visit high-risk areas are not eligible for IPTf for that month.



WHO's Sythong Souksysavad in Ka-I, one of the villages targeted by the CMPE's accelerator strategies which have been rolled out in Khammouane Province, Lao People's Democratic Republic. © WHO



Village malaria worker and schoolteacher, Pok Thiem, regularly travels by boat to visit the 30 households he covers under Cambodia's 'last mile' mile of malaria elimination. Thiem lives and works in Luon Thmey, a remote village inhabited by the Kreung minority in Stung Treng Province, Cambodia. Its proximity to the forest and river channels means it is a high-risk area for malaria. © WHO/A. Raab



Xu Yanchun, a laboratory specialist, holds blood smears that she will examine under a microscope for malaria parasites in the Yunnan Institute for Parasitic Diseases, China. Molecular analysis of dried blood spots from malaria patients helps to detect treatment failures and informs national malaria programmes if they need to update national treatment guidelines. © WHO/C. McNab



Antimalarial drug efficacy

In 2018, GMS ministers of health signed the Ministerial Call for Action to Eliminate Malaria in the Greater Mekong Subregion before 2030, acknowledging the ongoing threat of multidrug resistance. Partial resistance of *P. falciparum* to artemisinin was first confirmed along the Cambodia–Thailand border just over a decade ago. It has since been detected in Cambodia, Lao People’s Democratic Republic, Myanmar, Thailand and Viet Nam. Resistance to partner medicines, such as piperazine and mefloquine, has also emerged in some areas of the GMS.

The antimalarial drugs used across the GMS show high efficacy, thanks to the ongoing work of national malaria programmes, partners and WHO to update national treatment guidelines. Drug monitoring has been central to tracking the evolution of antimalarial resistance. GMS countries continue to use TES to monitor drug efficacy. In 2021, TES and monitoring exercises were completed in Cambodia, Lao People’s Democratic Republic and Viet Nam. As more countries move towards malaria elimination, national malaria programmes have started implementing iDES. With iDES, every patient is followed up, ensuring compliance with the full course of treatment and cure. Surveillance using iDES is already implemented nationwide in Thailand and has been rolled out in Viet Nam and Lao People’s Democratic Republic. Cambodia recently started an iDES pilot in one province.

The MME programme and GMS TES network continue to host annual meetings with national malaria programmes, donors and partners to review drug efficacy data and develop country-specific plans for efficacy monitoring. The Ninth Meeting of the Greater Mekong Subregion Therapeutic Efficacy Studies Network was held in September 2021. Countries were encouraged to continue monitoring the quality of TES based on the WHO quality control checklist. WHO also recommended that iDES be refined and rolled out, where feasible, ensuring the integration of iDES with laboratory microscopy and procedures to measure molecular markers.

Deletions in the *pfhrp2* and *pfhrp3* (*pfhrp2/3*) genes of the malaria parasite have previously been detected in studies from the China–Myanmar border. The deletions raise a concern for the subregion, because *pfhrp2* and *pfhrp3* are the target antigens for most rapid diagnostic tests used for *P. falciparum* malaria. WHO continues to encourage national malaria programmes across the subregion to conduct surveys and studies to map the prevalence and impact of *pfHRP2/3* deletions in the GMS.

Reflections from malaria donors



That Linn Tun (left) and Ma Myint San (right) dry sheets of rubber at a rubber camp in Mon State of Myanmar. Camp residents live and work on a rubber plantation close to the forest where malaria is spread and affects the population.
© WHO/V. Sokhin

BILL & MELINDA GATES FOUNDATION

Each time I open up the latest edition of the MME epidemiological bulletin, I am struck by the incredible progress that is being made towards elimination in the GMS. The very fact that we can accurately track this progress is the result of longstanding investment in strengthening surveillance systems, which has resulted in more accurate, timely and granular data. This precise epidemiological intelligence is driving smart strategic decisions and is helping to ensure that interventions are targeted and tailored to specific localities and populations. The scaling up of community case management for malaria has been an important pillar of progress, while layering on additional interventions to robustly target transmission foci has also been transformational. For *P. vivax*, we are already starting to see the impacts of early adoption of new diagnostics and scaling of radical cure. Technical challenges of course remain, but it has been encouraging to see a conscious effort to streamline and coordinate operational research efforts to address key programmatic questions, such as the potential use of prophylaxis in high-risk groups.

Based on sound strategy and committed execution, much of the GMS is on track to eliminate malaria in the next few years. The challenge will be to maintain the push for elimination through and beyond the last mile as external funding inevitably starts to ramp down. This is not just a question of identifying alternative sources of support – but also of moving to a progressively more efficient and integrated model of malaria programming that leverages existing health system capacity, especially at the subnational level.

JONATHAN COX, SENIOR PROGRAM OFFICER

GLOBAL FUND TO FIGHT AIDS, TUBERCULOSIS AND MALARIA

Since 2013, the Global Fund's Regional Artemisinin-resistance Initiative (RAI) has been investing in Cambodia, Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam. RAI is the Global Fund's largest regional grant and the first catalytic funding with the defined goal of disease elimination from a specific geographic region. The grant includes investments in health information systems, provision of integrated health services, and support for national health strategies and efficient supply chains, as well as operational research tackling specific challenges for control and elimination. The five countries aim to eliminate *P. falciparum* malaria by 2023 and eliminate all species of malaria by 2030. While the RAI grant focuses on eliminating *P. falciparum* and avoiding the spread of artemisinin resistance, countries will continue to rely on its support to ensure that the disease is not reintroduced. The GMS malaria elimination story continues to be an example for other regions. Malaria epidemiology in the five countries during the COVID-19 pandemic has been thoroughly reported in this bulletin, with an overall continuing decrease in *P. falciparum* and *P. vivax* cases, as well as a decrease in testing, likely a consequence of the pandemic. Focalized and innovative approaches are proving critical for malaria elimination. Notably, the close collaboration of partners at all levels allows continuous dialogue, creating trust with national malaria programmes. The Global Fund's COVID-19 Response Mechanism (C19RM) has allocated additional funding to protect gains made against malaria, with important investments in PPE and differential diagnosis of fever, and support to programmes and civil society to ensure access to care and continued surveillance. Both the C19RM and the RAI grant focus on strengthening integration of malaria control within the health system. This is absolutely essential in the last mile to elimination.

IZASKUN GAVIRIA, SENIOR FUND PORTFOLIO MANAGER

U.S. PRESIDENT'S MALARIA INITIATIVE

The GMS has made tremendous progress in the past decade towards malaria elimination, particularly driving down the incidence of *P. falciparum* malaria in recent years. Despite COVID-19, the GMS has fared remarkably well in maintaining malaria prevention, testing and treatment services. Community health workers and volunteers have undoubtedly been pivotal in maintaining essential malaria services despite global supply chain disruptions, interprovincial lockdowns and travel restrictions.

As elimination of *P. falciparum* malaria by 2023 is seemingly within reach in the GMS, prioritization of strategies to reach the unreached, particularly migrant and forest workers, is even more critical. Potential new tools such as topical repellents and drug-based interventions for forest goers and remaining foci are being evaluated and could be useful last mile strategies to interrupt *P. falciparum* transmission in the GMS.

In the context of elimination of drug-resistant parasites, the U.S. President's Malaria Initiative, through WHO, is supporting GMS countries to transition to monitoring drug efficacy and treatment outcomes through routine surveillance systems. The iDES approach aims to ensure that each malaria case is followed up and cured – ultimately contributing to a more robust health system infrastructure to address malaria and other health security threats. Using a dual investment case, opportunities and resources from national and global COVID-19 responses should be leveraged to build back stronger, more integrated and more resilient health systems for the future. To ensure longer term sustainability, increasing mobilization of domestic resources should be an integral part of this equation.

DAVID SINTASATH, REGIONAL MALARIA ADVISOR



A health worker conducts mosquito sampling and surveillance in Vientiane, Lao People's Democratic Republic. © WHO/Y. Shimizu



Malaria rapid diagnostic tests and laboratory microscope slides with blood samples used for monitoring treatment outcomes. To monitor drug efficacy, WHO, partners and national malaria programmes conduct TES across the GMS. © WHO/L. Pham



Village malaria worker Paen Narin (left) greets an elderly man from the indigenous Kreung community in Stung Treng, Cambodia. Narin screens villagers on a weekly basis. Malaria is a febrile illness – anyone presenting with a high temperature is tested for malaria and given treatment, if the test result is positive. © WHO/A. Raab



Conclusion

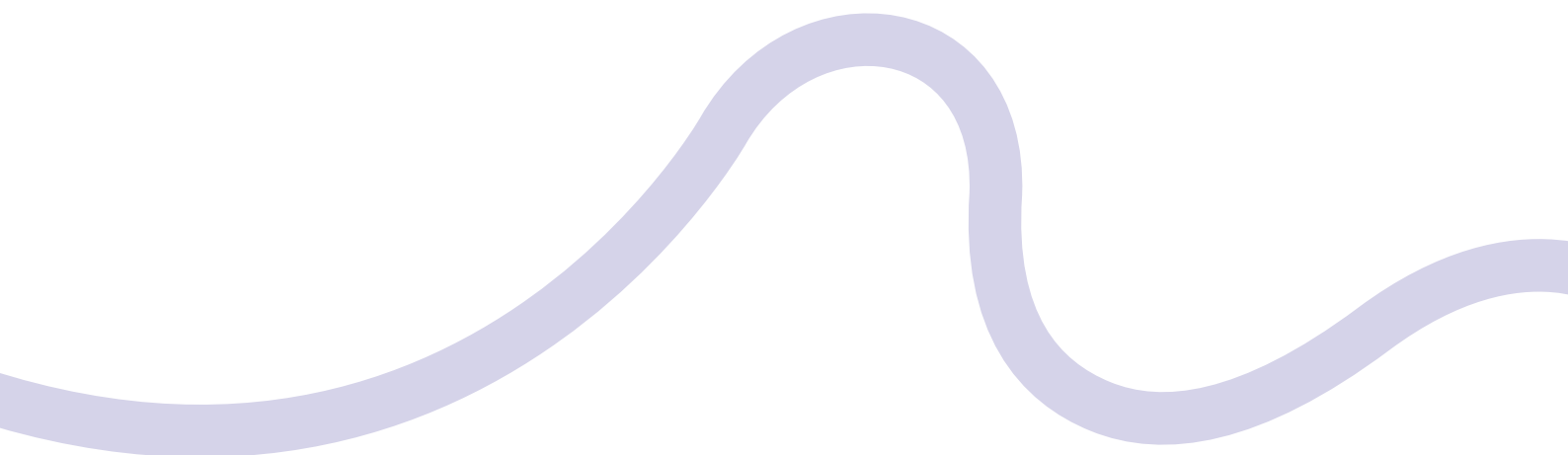
The ongoing commitment from, and coordination among, national malaria programmes, partners and donors is producing tangible progress towards malaria elimination. The GMS countries continue to reach record low case numbers while maintaining a high rate of testing. This success story has been made possible through the ongoing engagement and support from the communities affected by malaria. Tremendous efforts have been made to reach this stage. However, more energy and resources are needed to reach zero malaria and prevent re-establishment of transmission. With the *P. falciparum* elimination target fast approaching, all GMS countries are encouraged to align their malaria responses with the updated *WHO guidelines for malaria* (6). The November 2021 Workshop on WHO Policy Guidance on Malaria Elimination and the Implementation of Intensification Plans for Reducing the Malaria Burden in the Greater Mekong Subregion included recommendations to mainstream the existing WHO malaria elimination tools into national malaria work plans. The Malaria Elimination Assessment Tool exercise should ideally be carried out every year to identify gaps in programmes and assess progress towards malaria elimination.

Surveillance should continue to be a core intervention, and national malaria programmes need to fine-tune their surveillance systems for elimination. Countries should continue to provide the Malaria Elimination Database with access to the data of national surveillance systems and share more granular data, including information relating to cases and foci. In addition, national malaria programmes are encouraged to conduct surveillance assessments by using the Malaria Surveillance Assessment Toolkit elimination module. This will allow them to improve their systems and prepare for certification as malaria-free. To reduce the threat of antimalarial drug resistance, iDES should be refined and rolled out, where feasible.

The relative importance of *P. vivax* cases is likely to increase as countries approach elimination. Findings from the Second Forum on Operational Research in the Context of the Last Mile of Malaria Elimination in Greater Mekong Subregion Countries (November 2021) highlighted the multi-country efforts to integrate G6PD testing and implement a safe and effective *P. vivax* radical cure. National malaria programmes should continue to draw from WHO guidance and operational research findings to optimize the available tools that target *P. vivax* reservoirs.

Nuanced, proactive and targeted approaches are critical to eliminating *P. falciparum* malaria by 2023. When planning their focus-based responses, GMS countries are encouraged to consider the findings emerging from the focalized innovative approaches. This is particularly relevant for Myanmar as it plans to implement targeted and intensified responses to reach vulnerable populations living in high-risk sites.

As more countries engage in subnational malaria-free verification processes, national malaria programmes must coordinate with national institutions and authorities to maintain the necessary financial and human resources for low-malaria settings. This will encourage the horizontal integration of malaria in general health services and create the structures to prevent re-establishment.



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Residents of Kwai camp in Mon State of Myanmar. In Myanmar, populations at a high risk of contracting malaria include communities living and working in forest farms or plantations. © WHO/V. Sokhin





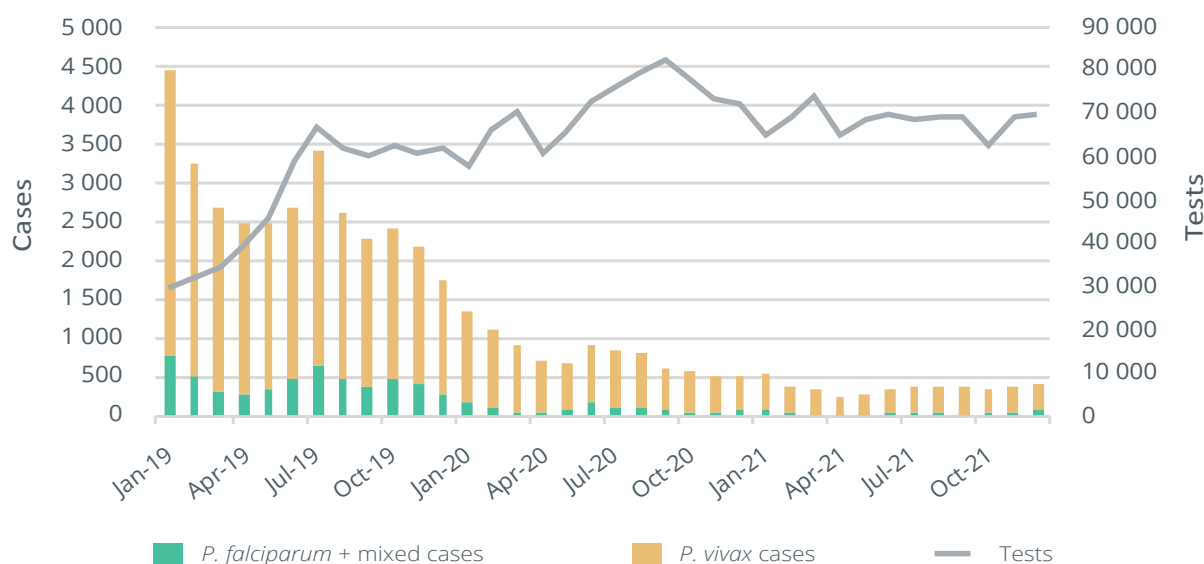
Annex: Malaria country profiles



CAMBODIA

Fig. 7

Malaria cases and tests in Cambodia, 2019-2021



National malaria strategies of the National Center for Parasitology, Entomology and Malaria Control

Targets

Malaria elimination action framework (2021–2025)
Malaria intensification plan for hard to reach populations

P. falciparum malaria eliminated by 2023
 Malaria eliminated by 2025

Interventions, policies and strategies

INTERVENTION	POLICIES AND STRATEGIES
Case management	Passive and active case detection
LLINs/LLIHNS	Yes
Indoor spraying with residual insecticide	No
Case classification	<ul style="list-style-type: none"> • L1: cases who have stayed every night within their current residence in the past two weeks. • LC: cases who have slept at least one night outside their village of current residence, but within Cambodia, in the past two weeks. • Imported: cases who have slept at least one night outside the country in the past two weeks. • Relapse/recrudescent: cases where the patient is diagnosed with <i>P. vivax</i> infection and reported having <i>P. vivax</i> in the past 12 months. • Reactive case detection for LC or imported <i>P. falciparum</i> or mixed cases, as well as <i>P. vivax</i> L1 cases in the village where the case was identified.

Interventions, policies and strategies	
Focus classification	<ul style="list-style-type: none"> Active focus: based on level of receptivity (potential transmission) and vulnerability (importation of parasite or infected vector). Areas are considered receptive when the abundant presence of vector anophelines and the prevailing ecological and climatic factors favour malaria transmission. Receptivity scoring is based on the presence of a permanent river or stream within 3 km of the focus boundary, the capture of <i>Anopheles</i> species, the distance to forest, and the occurrence of malaria cases among children <5 years old in the past 12 months. Areas are considered vulnerable when they are in proximity to malarious areas, or are prone to frequent influx of infected individuals or groups and/or infective anophelines. Vulnerability scoring is based on the percentage of travellers, the percentage of forest goers and the presence of work sites with high-risk populations in the village. The scoring for receptivity and vulnerability is weighted and determines the classification of the village. <p>Reclassification of foci.</p> <ul style="list-style-type: none"> Active focus: village from which at least one positive case has been investigated and classified as L1 within the past 12 months. Residual focus: village from which at least one positive case has been investigated and classified as L1 from 13 to 36 months. Cleared-up focus: village formerly defined as an active focus in which no cases investigated and classified as L1 have been detected in more than 36 months.
Focus response	<p>Implemented according to the receptivity and vulnerability scoring of the focus.</p> <ul style="list-style-type: none"> Recruitment and training of village and mobile malaria workers to provide passive case detection within the focus. Top-up of LLINs and continual distribution of LLINs to high-risk populations. Active fever screening conducted on a weekly basis for all high-risk populations within the focus. TDA: artesunate-mefloquine distributed to males aged 15–49 years within the receptive focus for two consecutive months at the beginning of response activities. IPTf: artesunate-mefloquine provided as a preventive measure to residents in an active focus who plan to go into nearby forested areas within the following month.

Current first-line antimalarial treatment policy	
All malaria cases	Artesunate-mefloquine + single low dose primaquine for <i>P. falciparum</i> + mixed cases; <i>P. vivax</i> radical cure for <i>P. vivax</i> + mixed cases upon G6PD test
Severe malaria	Intravenous injection of artesunate
Pregnant <i>P. falciparum</i> malaria cases	Quinine in first trimester; artesunate-mefloquine in second and third trimesters
Current second-line antimalarial treatment policy	
All malaria cases	Artesunate-pyronaridine + primaquine

Epidemiological profile by month (2021)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspected cases tested	64 563	69 240	73 576	64 730	68 611	69 433	68 631	68 928	68 963	62 412	68 951	70 691	818 729
Confirmed cases	545	383	338	241	270	339	373	369	377	325	373	396	4 329
<i>P. falciparum</i> cases	68	30	19	7	16	22	24	26	17	25	29	58	341
<i>P. vivax</i> cases	477	351	319	219	253	315	349	343	360	300	344	338	3 968
Mixed cases	0	2	0	15	1	2	0	0	0	0	0	0	20
Other cases	0	0	0	0	0	0	0	0	0	0	0	0	0
Cases investigated	308	303	303	203	257	327	373	370	377	339	380	408	3 948
Cases classified	308	302	303	203	257	327	373	370	377	339	380	408	3 947
Imported cases	0	0	0	0	0	0	0	0	0	0	0	0	0

CHINA

(YUNNAN PROVINCE)

Interventions, policies and strategies	
INTERVENTION	POLICIES AND STRATEGIES
Case management	Passive and active case detection
LLINs/LLIHNS	Yes
Indoor spraying with residual insecticide	Yes
Case classification	<ul style="list-style-type: none"> Indigenous case: a case contracted within national boundaries. Imported case: a case where the origin can be traced to a known malaria-endemic area outside the national borders where the case has travelled within one month. Unknown: where the origin of infection cannot be determined.
Focus classification	<ul style="list-style-type: none"> Focus with current transmission: focus reporting introduced case(s) and determined to be at risk of local transmission. Focus with transmission potential: focus reporting imported cases in transmission season and having malaria vectors. Focus without transmission potential: focus reporting imported cases that do not have malaria vectors, or malaria vectors are present but not in transmission season.
Focus response	<ul style="list-style-type: none"> Focus with current transmission: <ul style="list-style-type: none"> focus with only one introduced case – enhanced laboratory detection of malaria parasites among feverish patients; clearing of infectious sources among residents through provision of antimalarials; indoor residual spraying; mass health education; focus with two or more introduced cases – investigation to track the sources of infection; mass blood testing; enhanced surveillance of infectious sources in all town/township hospitals, community health centres and medical institutions; referral of suspected feverish patients from village health posts; interventions to clear infectious sources among residents; indoor residual spraying; mass health education. Focus with transmission potential: indoor residual spraying and mass health education. Focus without transmission potential: health education.

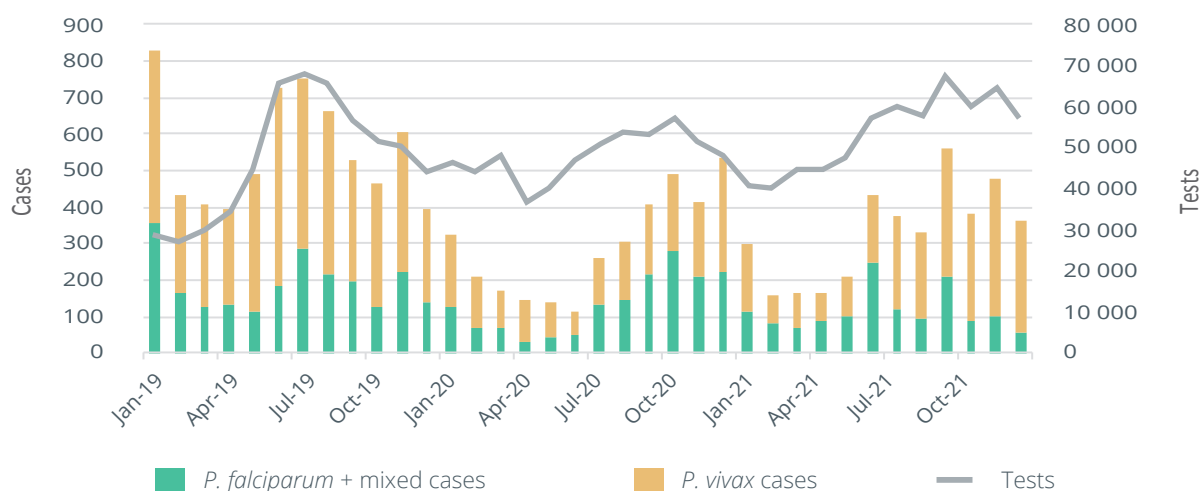
Current first-line antimalarial treatment policy	
<i>P. falciparum</i> malaria	Dihydroartemisinin–piperaquine
<i>P. vivax</i> malaria	Chloroquine + primaquine (8 days)
Severe malaria	Artesunate injection
Current second-line antimalarial treatment policy	
All malaria cases	Piperaquine, pyronaridine or ACTs

Epidemiological profile by month (2021)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Deaths	0	0	0	0	0	0	0	0	0	0			0
Suspected cases tested	5 946	7 548	9 776	10 577	15 578	14 546	13 867	13 634	11 412	8539			111 423
Confirmed cases	5	5	8	12	12	30	30	9	4	7			122
<i>P. falciparum</i> cases	0	0	0	0	0	0	0	0	0	0			0
<i>P. vivax</i> cases	4	5	8	12	12	30	30	9	4	7			121
Mixed cases	0	0	0	0	0	0	0	0	0	0			0
Other cases	1	0	0	0	0	0	0	0	0	0			1
Cases investigated	N/A												122
Cases classified	N/A												122
Imported cases	5	5	8	12	12	30	30	9	4	7			122

Note: November and December 2021 data from Yunnan Province was unavailable at the time of publication.

LAO PEOPLE'S DEMOCRATIC REPUBLIC

Fig. 8
Malaria cases and tests in Lao People's Democratic Republic, 2019–2021



National malaria strategy of the Center for Malaria, Parasitology, and Entomology

National strategic plan for malaria control and elimination (2021–2025)

Targets

P. falciparum malaria eliminated by 2023
Malaria eliminated by 2030

Interventions, policies and strategies

INTERVENTION	POLICIES AND STRATEGIES
Case management	Passive and active case detection
LLINs/LLIHNS	Yes
Indoor spraying with residual insecticide	Yes
Case classification	<p>Locally acquired if the patient has not travelled to any location away from their current address within the past two weeks and classified as either:</p> <ul style="list-style-type: none"> • indigenous; or • introduced. <p>Not locally acquired if the patient has travelled away from their current address to an area that is known for, or receptive to, malaria transmission – the case is usually classified as imported:</p> <ul style="list-style-type: none"> • recrudescence <i>P. falciparum</i> or relapse of <i>P. vivax</i> or <i>P. ovale</i>; • induced; • imported from another district; • imported from another province; or • imported from another country. <p>Reactive case detection: screening populations in the index case household (patient's current address) and travel companions who the patient travelled overnight with in the previous 28 days.</p>

Interventions, policies and strategies

Focus classification	<ul style="list-style-type: none"> Active focus: locally acquired case found in the focus in the past 12 months. Residual non-active focus: no new locally acquired cases detected in the focus for 12 months. Cleared: no new locally acquired cases detected in the focus for three years.
Focus response	<ul style="list-style-type: none"> Implemented in the whole focus (village) where a case is classified as locally acquired. Reactive case detection to screen all populations within 1 km radius of the index case (or 500 m radius for urban infections); testing criteria and treatment of all positive cases are based on the national malaria treatment guidelines. Mapping the occurrence of transmission, vector breeding locations and risk populations in the focus area. Evaluating vector control activities and providing supplementary vector control if required (indoor residual spraying and/or LLIN top-up). Entomological data collection (ad hoc when it is considered critical to the focus response). Supervision of health centre and village malaria workers. Survey to identify at-risk populations and determine the focus population's behaviour and potential activities that might put them at risk of malaria. Information, education and communication activities.

Current first-line antimalarial treatment policy

Uncomplicated <i>P. falciparum</i> malaria	Single low dose of artemether–lumefantrine + single low dose of primaquine
Severe <i>P. falciparum</i> malaria	Artemisinin injection and single low dose of artemether–lumefantrine + primaquine
Uncomplicated <i>P. vivax</i> malaria	Artemether–lumefantrine + primaquine and a G6PD test
Pregnant <i>P. falciparum</i> malaria cases	Oral dose of quinine in the first trimester; artemether–lumefantrine in the second and third trimesters
Pregnant <i>P. vivax</i> malaria cases	Oral dose of chloroquine in the first trimester; artemether–lumefantrine in the second and third trimesters

Current second-line antimalarial treatment policy

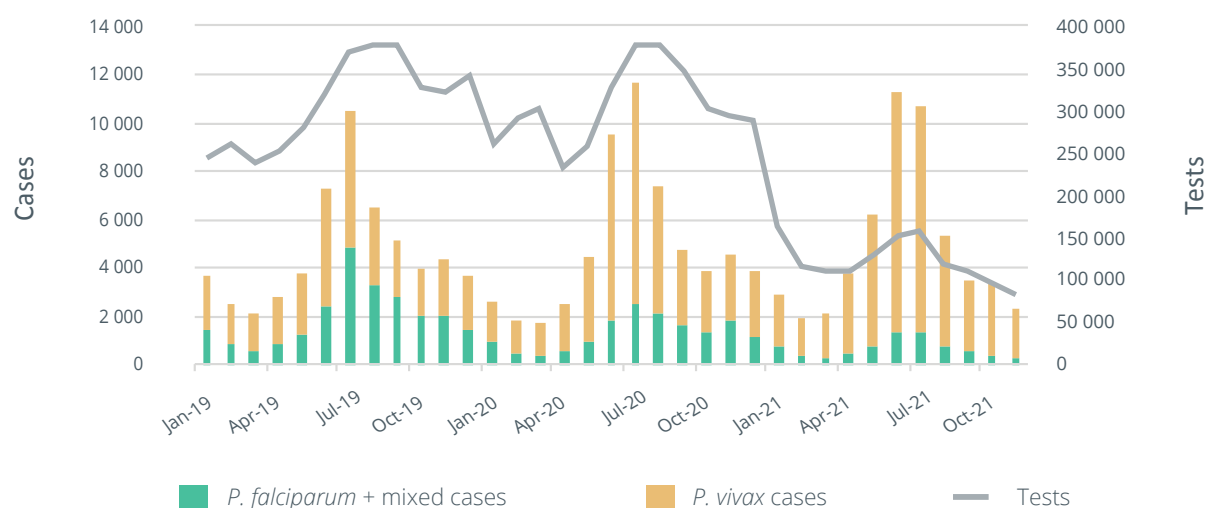
Uncomplicated <i>P. falciparum</i> malaria	Quinine and doxycycline and single low dose of primaquine
Severe <i>P. falciparum</i> malaria	Quinine infusion and a single low dose of artemether–lumefantrine + primaquine
Uncomplicated <i>P. vivax</i> malaria	Oral dose of chloroquine + primaquine and a G6PD test

Epidemiological profile by month (2021)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Deaths	0	0	0	0	0	0	0	0	1	0	0	0	1
Suspected cases tested	40 893	40 013	44 544	44 390	47 777	57 134	59 955	57 781	67 248	60 251	64 666	56 942	641 594
Confirmed cases	296	158	161	161	211	429	374	333	559	379	474	361	3 896
<i>P. falciparum</i> cases	110	78	63	87	98	246	115	86	209	85	99	54	1 330
<i>P. vivax</i> cases	185	79	95	73	111	183	257	241	350	294	372	305	2 545
Mixed cases	1	1	3	1	2	0	2	6	0	0	3	2	21
Other cases	0	0	0	0	0	0	0	0	0	0	0	0	0
Cases investigated	4	11	10	10	12	35	23	14	18	27	6	5	175
Cases classified	4	12	9	11	12	33	27	14	17	20	7	9	175
Imported cases	1	4	2	7	2	12	7	1	2	1	3	7	49

MYANMAR

Fig. 9
Malaria cases and tests in Myanmar, 2019–2021



National malaria strategies of the National Malaria Control Programme

National plan for malaria elimination in Myanmar (2016–2030)
National strategic plan for malaria elimination (2021–2025)

Targets

P. falciparum malaria eliminated by 2023
Malaria eliminated by 2030

Interventions, policies and strategies

INTERVENTION	POLICIES AND STRATEGIES
Case management	Passive and active case detection
LLINs/LLIHNS	Yes
Indoor spraying with residual insecticide	Yes
Case classification	<p>Locally acquired if a case is due to mosquito-borne transmission and acquired within the area of investigation.</p> <ul style="list-style-type: none"> Indigenous: any case contracted locally, without strong evidence of a direct link to an imported case. Introduced: any case contracted locally, with strong epidemiological evidence linking it directly to a known imported case. Relapsed: true relapse from <i>P. vivax</i> or <i>P. ovale</i> hypnozoites that were contracted locally some time ago. <p>Not locally acquired.</p> <ul style="list-style-type: none"> Imported case: due to mosquito-borne transmission and acquired outside the area where it is diagnosed; the origin of imported cases can be traced to a known malarious area outside the elimination area to which the case has travelled (within 3 months). Induced case: not due to mosquito-borne transmission.

Interventions, policies and strategies	
Focus classification	<ul style="list-style-type: none"> Active focus: ongoing transmission in focus, with locally acquired cases detected within the current calendar year. Residual non-active focus: the last locally acquired case(s) was detected in the previous calendar year or up to three years ago. Cleared focus: a focus with absence of locally acquired cases(s) for more than three years, where only imported and/or relapsed/recrudescent cases and/or induced cases may occur in the current calendar year.
Focus response	<ul style="list-style-type: none"> Active focus: high coverage of appropriate vector control (LLINs and indoor residual spraying). Passive case detection throughout the year and active case detection (with screening and testing or with testing alone) at appropriate intervals, especially just before or during the transmission season. If testing is chosen and no cases have been found after several rounds of active case detection, frequency of active case detection may be reduced or strategy may be changed to active surveillance for suspected clinical cases that can be tested and managed as necessary. Residual non-active focus: passive case detection throughout the year and active case detection considered during key times. People most likely to have malaria are screened to identify local cases. If several rounds of active case detection reveal no cases, the frequency may be reduced. If new introduced or indigenous cases are identified, further evaluation is required to determine whether local transmission has resumed. Cleared focus: programme relies on the surveillance system to rapidly identify any cases of suspected malaria and determine whether local transmission has resumed.

Current first-line antimalarial treatment policy	
Uncomplicated <i>P. falciparum</i> malaria	Artemether–lumefantrine for 3 days + primaquine at day 2
Pregnant <i>P. falciparum</i> malaria cases	Oral dose of quinine and clindamycin for 7 days in the first trimester and artemether–lumefantrine for 3 days in the second and third trimesters
Mixed malaria cases	Artemether–lumefantrine for 3 days + primaquine for 14 days
<i>P. vivax</i> , <i>P. ovale</i> or <i>P. malariae</i> malaria	Chloroquine + primaquine for 14 days (primaquine not given for <i>P. malariae</i>)
Current second-line antimalarial treatment policy	
Uncomplicated <i>P. falciparum</i> malaria	Alternate ACT + primaquine at day 2

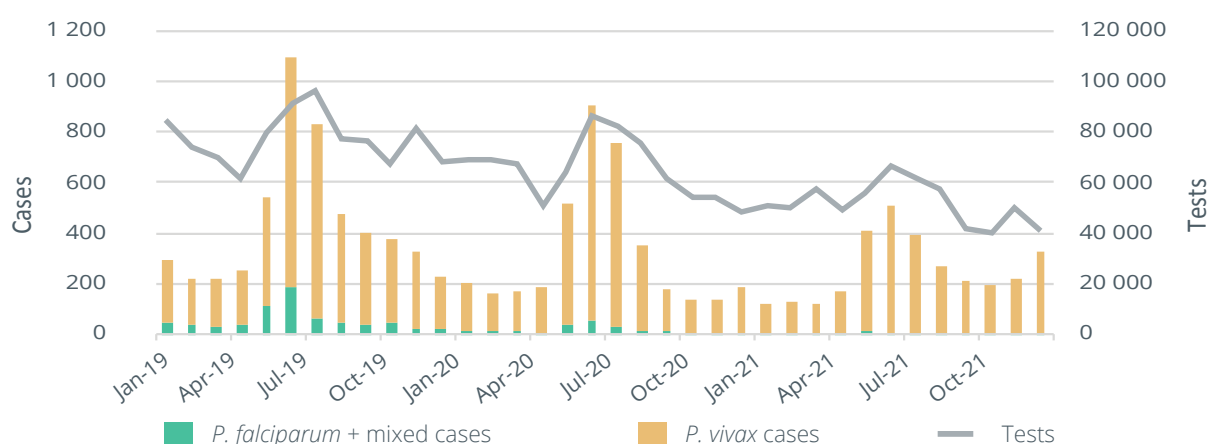
Epidemiological profile by month (2021)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Deaths	0	0	0	0	0	2	2	1	0	0	1		6
Suspected cases tested	164 382	115 737	109 967	110 203	131 289	152 571	157 181	119 498	109 322	98 032	83 144		1 351 326
Confirmed cases	2 892	1 884	2 093	3 732	6 226	11 304	10 728	5 357	3 434	3 379	2 285		53 314
<i>P. falciparum</i> cases	699	366	252	443	705	1 317	1 308	766	551	381	283		7 071
<i>P. vivax</i> cases	2 170	1 499	1 825	3 273	5 502	9 965	9 376	4 559	2 863	2 979	1 981		45 992
Mixed cases	23	19	16	16	19	22	44	32	20	19	21		251
Other cases	0	0	0	0	0	0	0	0	0	0	0		0
Imported cases	0	0	0	0	0	0	0	0	0	0	0		0

Note: December 2021 data from Myanmar was unavailable at the time of publication.
Thailand

THAILAND

Fig. 10

Malaria cases and tests in Thailand, 2019–2021



National malaria strategies of the Division of Vector Borne Diseases

National malaria elimination strategy (2017–2026)
Malaria elimination operational plan (2021–2025)

Targets

P. falciparum malaria eliminated by 2023
Malaria eliminated by 2024

Interventions, policies and strategies

INTERVENTION	POLICIES AND STRATEGIES	
Case management	Passive and active case detection	
LLINs/LLIHNS	Yes	
Indoor spraying with residual insecticide	Yes	
Case classification	Indigenous: <ul style="list-style-type: none"> A: in resident village B: outside resident village Bx: outside village By: outside canton Bz: outside district Bo: outside province 	Imported: <ul style="list-style-type: none"> Bf: outside country C: relapsed D: induced E: introduced F: unclassified
Focus classification	<ul style="list-style-type: none"> Active focus (A1): indigenous cases found in current year. Residual non-active focus (A2): no indigenous cases for 1–3 years. Cleared focus but receptive (B1): no indigenous cases for >3 years + vector/suitable environment. Cleared focus and non-receptive (B2): no indigenous cases for >3 years + no vector. 	
Focus response	<ul style="list-style-type: none"> Active focus (A1): 1–3–7 surveillance; passive case detection at community level and health facilities; reactive case detection; two rounds of proactive case detection for persistent indigenous focus; supervised treatment and follow-up through iDES; focus investigation with entomological surveillance (for persistent indigenous focus); LLINs and/or LLIHNS (at least 90% coverage); and behaviour change communication. Residual non-active focus (A2): 1–3–7 surveillance; passive case detection at community level and health facilities; reactive case detection; one round of proactive case detection; supervised treatment and follow-up through iDES; focus investigation with entomological surveillance (if active focus); LLINs and/or LLIHNS (at least 90% coverage); and behaviour change communication. Receptive focus (B1): 1–3–7 surveillance; passive case detection at health facilities; supervised treatment and follow-up through iDES; and behaviour change communication. Non-receptive focus (B2): 1–3–7 surveillance; passive case detection at health facilities; supervised treatment and follow-up through iDES; focus investigation, entomological survey and mass blood screening if indigenous case is confirmed; vector control (insecticide-treated nets and indoor residual spraying) if transmission is confirmed; and behaviour change communication. 	

Current first-line antimalarial treatment policy

Uncomplicated <i>P. falciparum</i> malaria	Dihydroartemisinin–piperaquine for 3 days + a single dose of primaquine (except in Sisaket and Ubon Ratchatani, where patients receive artesunate–pyronaridine for 3 days + single dose of primaquine)
Uncomplicated <i>P. vivax</i> or <i>P. ovale</i> malaria	Chloroquine for 3 days + low dose (0.25–0.30 mg/kg) of primaquine for 14 days
<i>P. malariae</i> or <i>P. knowlesi</i> malaria	Chloroquine for 3 days
Mixed <i>P. falciparum</i> with <i>P. vivax</i> or <i>P. ovale</i> malaria	Dihydroartemisinin–piperaquine for 3 days + low dose (0.25–0.30 mg/kg) of primaquine for 14 days
Mixed <i>P. falciparum</i> with <i>P. malariae</i> or <i>P. knowlesi</i> malaria	Dihydroartemisinin–piperaquine for 3 days + single dose of primaquine
Severe malaria cases	Artesunate injection within the first 24 hours, followed by first or second regimen when the patient can take medicine, with supportive care
Pregnant <i>P. falciparum</i> malaria cases	Quinine and clindamycin for 7 days in first trimester; dihydroartemisinin–piperaquine for 3 days without primaquine in second and third trimesters
Pregnant <i>P. vivax</i> , <i>P. ovale</i> , <i>P. malariae</i> and <i>P. knowlesi</i> malaria cases	Chloroquine for 3 days without primaquine

Current second-line antimalarial treatment policy

Uncomplicated <i>P. falciparum</i> malaria	Artesunate–pyronaridine for 3 days + single dose of primaquine; artemether–lumefantrine for 3 days + single dose of primaquine; or artesunate–mefloquine for 3 days + single dose of PQ
Uncomplicated <i>P. vivax</i> or <i>P. ovale</i> malaria	Dihydroartemisinin–piperaquine for 3 days + low dose of primaquine for 14 days
Severe malaria cases	Quinine injection within the first 24 hours, followed by first or second regimen when the patient can take medicine, with supportive care

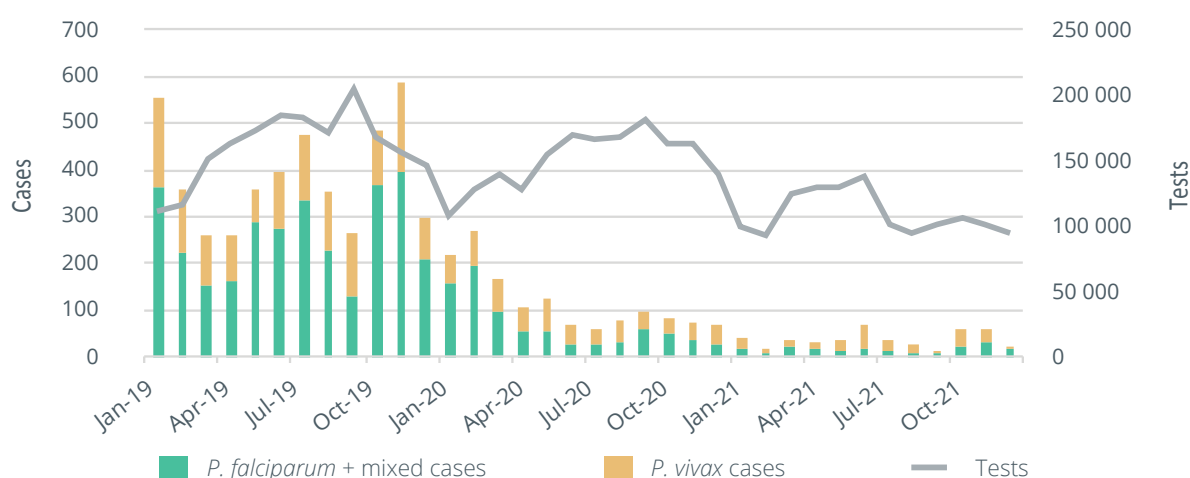
Epidemiological profile by month (2021)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Deaths	Data not officially available												
Suspected cases tested	50 935	49 910	57 823	49 338	56 003	66 900	61 873	57 636	41 612	40 301	49 635	40 682	622 648
Confirmed cases	127	133	140	179	417	525	406	271	223	202	222	332	3 177
<i>P. falciparum</i> cases	4	4	8	3	8	7	2	5	1	6	6	6	60
<i>P. vivax</i> cases	115	121	113	164	403	504	391	262	213	190	212	317	3 005
Mixed cases	2	2	0	0	1	0	3	1	0	1	0	0	10
Other cases	6	6	19	12	5	14	10	3	9	5	4	9	102
Cases investigated	127	130	139	178	410	511	399	266	218	202	220	324	3 124
Cases classified	127	130	139	178	410	511	399	266	218	202	220	324	3 124
Imported cases	8	13	22	17	79	106	142	76	64	62	82	125	796

VIET NAM

Fig. 11

Malaria cases and tests in Viet Nam, 2019–2021



National malaria strategies of the National Institute of Malaria, Parasitology, and Entomology

National strategy for malaria control and elimination in the period 2011–2020 and orientation to 2030

Targets

P. falciparum malaria eliminated by 2023
Malaria eliminated by 2030

Interventions, policies and strategies

INTERVENTION	POLICIES AND STRATEGIES
Case management	Passive and active case detection
LLINs/LLIHNS	Yes
Indoor spraying with residual insecticide	Yes
Case classification	<ul style="list-style-type: none"> Indigenous case: a parasitologically confirmed malaria case, locally transmitted (commune/ward), with no evidence of being imported and not directly related to infection from imported case. Imported case: a parasitologically confirmed malaria case, transmitted from another place or country; in the context of subnational elimination, an imported case is defined when the infection is acquired outside a designated geographic area, such as a province or commune. Secondary malaria case: a parasitologically confirmed malaria case, locally transmitted from an imported malaria case; this is equivalent to an introduced case.
Focus classification	<ul style="list-style-type: none"> Active focus: the area has at least one parasitologically confirmed case of locally transmitted malaria in the current calendar year. Potential: the area has no locally transmitted malaria cases in the current calendar year and at least one confirmed locally transmitted case of malaria was detected within the previous 3 calendar years. Controlled: an area with no parasitologically confirmed locally transmitted malaria cases in 3 calendar years or more.
Focus response	<p>Focus investigations depend on extent of transmission of the focus.</p> <ul style="list-style-type: none"> Surveillance: enhanced focus surveillance, including number of malaria cases in the focus, use of malaria prevention and control measures, and patterns of mobile migrant populations. Case detection and treatment: active and passive case detection; all confirmed malaria cases are treated. Vector prevention and control measures, including indoor residual spraying, distribution of LLINs, and management/clearance of larval sources. Behaviour change communication.

Current first-line antimalarial treatment policy	
Uncomplicated <i>P. falciparum</i> , or <i>P. falciparum</i> mixed with <i>P. malariae</i> or <i>P. knowlesi</i> malaria	Dihydroartemisinin–piperaquine + single dose of primaquine (except in six provinces with piperaquine resistance, where patients receive artesunate–pyronaridine or artesunate–mefloquine + single dose of primaquine)
Uncomplicated <i>P. falciparum</i> mixed with <i>P. vivax</i> or <i>P. ovale</i> malaria	Dihydroartemisinin–piperaquine + primaquine (14 days) (except in six provinces with piperaquine resistance, where patients receive artesunate–pyronaridine or artesunate–mefloquine + single dose of primaquine)
Uncomplicated <i>P. vivax</i> or <i>P. ovale</i> malaria	Chloroquine + primaquine (14 days)
Uncomplicated <i>P. malariae</i> or <i>P. knowlesi</i> malaria	Chloroquine + single dose of primaquine
Severe malaria cases	Injection of artesunate or artemether
CURRENT SECOND-LINE ANTIMALARIAL TREATMENT POLICY	
Uncomplicated <i>P. falciparum</i> or mixed <i>P. falciparum</i> malaria	Artesunate–pyronaridine or artesunate–mefloquine or quinine + doxycycline (7 days) (except in six provinces with piperaquine resistance, where patients do not receive artesunate–pyronaridine or artesunate–mefloquine)
Uncomplicated <i>P. vivax</i> or <i>P. ovale</i> malaria	Dihydroartemisinin–piperaquine + primaquine (14 days)
Uncomplicated <i>P. malariae</i> or <i>P. knowlesi</i> malaria	Dihydroartemisinin–piperaquine + single dose of primaquine
Severe malaria cases	Quinine dihydrochloride

Epidemiological profile by month (2021)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspected cases tested	98 937	92 798	125 048	130 068	129 902	137 760	100 607	94 499	101 726	107 008	100 678	94 617	1 313 648
Confirmed cases	39	18	36	33	37	71	37	26	15	62	61	24	459
<i>P. falciparum</i> cases	19	10	22	20	12	19	12	8	7	23	33	20	205
<i>P. vivax</i> cases	19	8	14	13	25	52	25	18	8	37	28	4	251
Mixed cases	1	0	0	0	0	0	0	0	0	0	0	0	1
Other cases	0	0	0	0	0	0	0	0	0	2	0	0	2
Imported cases	5	6	7	7	6	3	3	3	0	0	5	7	52

MEKONG MALARIA ELIMINATION PROGRAMME

The WHO Mekong Malaria Elimination (MME) programme is an initiative that supports malaria elimination strategies across the six countries of the Greater Mekong subregion (GMS). Located in Phnom Penh, Cambodia, it was established in 2017 as a reaction to the *Emergency response to artemisinin resistance in the Greater Mekong subregion*, a high-level plan launched in 2013 to contain the spread of antimalarial drug-resistant parasites and provide life-saving interventions for all populations at risk of malaria in the subregion. The MME programme works in close collaboration with the WHO country offices, WHO regional offices in the Western Pacific and South-East Asia, the WHO Global Malaria Programme, national malaria programmes and partners to:

1. Promote dialogue, partnerships and coordination:

- Advocate on the prevention, diagnosis and treatment of malaria.
- Facilitate preparation towards malaria-free certification by countries.
- Organize regional thematic conferences related to therapeutic efficacy studies, malaria surveillance, WHO malaria guidance and operational research.

2. Optimize regional and country surveillance:

- Monitor drug efficacy and strengthen malaria surveillance systems.
- Provide technical support to enhance existing malaria information systems.
- Coordinate and publish epidemiological data on malaria elimination across the six countries through the Malaria Elimination Database.

3. Facilitate targeted advocacy and communications on the ongoing efforts to eliminate malaria in the GMS.

- Publish stories, reports and partner updates to highlight progress, share lessons learned and maintain commitment to malaria elimination targets in the GMS countries.

4. Provide technical support on accelerating strategies towards malaria elimination:

- Define strategies, and plan and support the implementation of intensification plans and focalized innovative approaches.
- Deploy decentralized technical assistance in the GMS to facilitate the implementation of country-specific malaria interventions.

The Malaria Elimination Database is a cornerstone of the MME programme. The regional platform collects monthly malaria data at district and lower levels. It allows GMS countries to strengthen surveillance, enhance monitoring and evaluation, analyse malaria distribution and trends, and share data through monthly epidemiological summaries and annual bulletins..



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