MEETING FOR STRENGTHENING SURVEILLANCE OF MALARIA CONTROL AND ELIMINATION IN THE WESTERN PACIFIC REGION

21–23 June 2017
Manila, Philippines
MEETING REPORT

MEETING FOR STRENGTHENING SURVEILLANCE OF MALARIA CONTROL AND ELIMINATION IN THE WESTERN PACIFIC REGION

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NOTE

The views expressed in this report are those of the participants of the Meeting for Strengthening Surveillance of Malaria Control and Elimination in the Western Pacific Region and do not necessarily reflect the policies of the World Health Organization.

This report was prepared by the World Health Organization Regional Office for the Western Pacific for governments of Member States in the Region and for those who participated in the Meeting for Strengthening Surveillance of Malaria Control and Elimination in the Western Pacific Region, which was held in Manila, Philippines from 21 to 23 June 2017.
# TABLE OF CONTENTS

**ACRONYMS**

**SUMMARY**

## 1. INTRODUCTION ............................................................................................................................. 1
   1.1 Background .................................................................................................................................. 1
   1.2 Objectives .................................................................................................................................... 2
   1.3 Opening remarks .......................................................................................................................... 2
   1.4 Nomination of chair, vice-chair and rapporteur ........................................................................... 2

## 2. PROCEEDINGS ................................................................................................................................ 3
   2.1 Technical session 1: Global and regional updates ................................................................. 3
   2.2 Technical session 2: Surveillance in burden reduction countries ........................................ 7
   2.3 Technical session 3: Surveillance in countries transitioning towards elimination ............. 9
   2.4 Technical session 4: Clarifying surveillance on the pathway to elimination ..................... 11
   2.5 Technical session 5: Surveillance in countries targeting elimination by 2020 .................. 14
   2.6 Technical session 6: WHO global and regional malaria surveillance databases ............ 16
   2.7 Technical session 7: Clarifying components of malaria surveillance ............................... 17
   2.8 Technical session 8: Consensus-building for national surveillance platforms .................. 18

## 3. CONCLUSIONS AND RECOMMENDATIONS .......................................................................... 20

**ANNEXES**

   Annex 1 - Core data elements for surveillance in the Western Pacific Region .................... 22
   Annex 2 - Timetable ......................................................................................................................... 23
   Annex 3 - List of participants ......................................................................................................... 26

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Keywords:

Malaria - epidemiology, prevention and control / Disease vectors / Regional health planning
ABBREVIATIONS

ACT  -  artemisinin-based combination therapy
API   -  annual parasite incidence
CMPE  -  Center of Malariology, Parasitology and Entomology (Lao People’s Democratic Republic)
CNM   -  National Center for Parasitology, Entomology and Malaria Control (Cambodia)
DHIS  -  district health information system
GMS   -  Greater Mekong Subregion
HII    -  Health Intelligence and Innovation
IRM   -  insecticide resistance monitoring
LLIN   -  long-lasting insecticidal net
NIMPE -  National Institute of Malariology, Parasitology and Entomology (Viet Nam)
NMP   -  national malaria programme
PCR   -  polymerase chain reaction
RDT   -  rapid diagnostic test
SDG   -  Sustainable Development Goal
SUMMARY

The Global Technical Strategy for Malaria 2016–2030 and the Regional Action Framework for Malaria Control and Elimination in the Western Pacific 2016–2020 emphasize a fundamental shift in strategy to make surveillance a core intervention in malaria control and elimination. Having surveillance as a core intervention will require countries to review and update their tools, procedures, human resources and structures. Establishing elimination-capable surveillance systems, that is a system able to identify and monitor malaria cases and foci for classification and response, countries will be equipped to accelerate towards elimination as well as to prevent secondary transmission and re-introduction.

The Regional Action Framework has identified a core set of indicators and milestones to track progress towards elimination in the Western Pacific. However, most national surveillance systems in the Region are not equipped with the tools to readily detect and notify malaria cases for the purpose of investigation, classification and follow-up. While countries targeting elimination by 2020 – China, Malaysia and the Republic of Korea – have established surveillance systems capable of achieving elimination, other national malaria control programmes are adopting the District Health Information System, a scalable, web-based platform with elimination functional modules.

In order to provide a forum to share information and lessons learnt and reach consensus on a core set of indicators and common platform to accelerate towards elimination, the WHO Western Pacific Regional Office, Malaria other Vectorborne and Parasitic Diseases unit convened this meeting with participants from national malaria programmes of the Ministries of Health, partners, malaria experts and WHO secretariat to strengthen malaria surveillance through technical discussions and consensus-building about national and regional surveillance platforms and a way forward.

The technical sessions on the first day included global and regional updates and highlights from national programmes in burden reduction and elimination settings. The WHO Global Malaria Programme recently launched Malaria Surveillance, Monitoring and Evaluation: An Operational Manual, which was presented and followed by a detailed account of Pillar 3 (strengthening surveillance) of the Regional Action Framework. The regional surveillance indicators were introduced and the Regional Office’s district health information system version 2 (DHIS2) platform and tools for national data submission to the Regional Office were presented. The delegations from high malaria burden countries, including the Lao People’s Democratic Republic, Papua New Guinea and Solomon Islands, presented updates on their malaria surveillance systems and highlighted strengths and challenges to meet regional requirements. The delegations from countries transitioning towards elimination, including Cambodia, the Philippines, Vanuatu and Viet Nam presented updates and challenges of their progress.

The technical sessions on the second day began with presentations surrounding surveillance on the pathway towards elimination followed by the World Malaria Report 2017, use of the DHIS2 platform in burden reduction and elimination settings, and surveillance in countries targeting elimination by 2020 including China, Malaysia and the Republic of Korea. The afternoon sessions included a presentation by the University of Oslo group on using the DHIS2 data tracker system to map and follow individual cases and foci and a presentation by the Health Intelligence and Innovation unit of the WHO Regional Office for the Western Pacific about the importance of maintaining organizational units to improve integration of data across technical units.

The third day included technical presentations and discussions starting with definitions of malaria surveillance indicators and terms used during elimination and prevention of re-introduction in countries having eliminated malaria. Drug resistance monitoring and the malaria surveillance database at the global and regional levels were presented and discussed. Consensus-building was done for regional and national elimination-ready surveillance platforms including discussions about data submission tools and regional milestones and timelines for data submission. An interactive session of
the regional DHIS2 platform was held, followed by a discussion about conclusions and recommendations for national malaria control programmes and WHO.

Member States agreed to develop national malaria surveillance guidelines and standard operating procedures based on WHO regional and global surveillance and elimination manuals and frameworks. The surveillance guidelines should be developed in the context of national capacity and include updated national malaria surveillance tools, procedures, people and structures needed to transition towards elimination-capable surveillance. Countries still working towards burden reduction were urged to improve surveillance from the lowest administration levels, focusing on reporting completeness and data quality with accurate parasitological diagnosis and case management. Once established and fully functional, the surveillance system may be improved in a step-by-step manner by integrating elimination requirements as capacity allows and disease burden is reduced; countries targeting elimination must use strengthened surveillance systems for better case and foci identification, investigation, classification and follow-up with active case detection and monitoring of environmental vulnerability and receptivity. All countries were requested to submit data to WHO within three months of the conclusion of the meeting, including monthly subnational data, disaggregated by age and gender for 2015–2017, and to use new indicators for surveillance from 2018.

It was recommended that the WHO Secretariat consider malaria surveillance enhancement as an integrated systems strengthening strategy. As national and regional malaria DHIS2 platforms improve through surveillance strengthening, additional disease surveillance efforts can be integrated in the database, similar to the regional DHIS2 platform housed in the Health Intelligent and Innovation unit of the Regional Office. An additional recommendation to the Secretariat was to mobilize resources to continue the provision of country technical and financial support in implementation of surveillance strengthening activities, such as technical assistance during the development of national surveillance guidelines. The Regional Office should continue regional activities to support countries in strengthening their malaria surveillance, supporting data submission for the regional database and the World Malaria Reports, and facilitating external quality assessment of data quality and completeness. The Regional Office will support and facilitate monthly and annual data submissions at regional and global levels by the national malaria programmes.
1. INTRODUCTION

1.1 Background

The 10 malaria-endemic countries in the Western Pacific Region have progressed significantly towards reducing malaria morbidity and mortality. All malaria-endemic countries in the Region except Papua New Guinea decreased malaria cases by over 64% and deaths from malaria fell by over 95% between 2000 and 2015. Still, malaria continues to pose a significant public health threat with nearly 40% of the 1.8 billion people in the Region at risk of malaria infection, including more than 30 million people at high risk. Malaria disproportionately affects ethnic minorities, migrant workers and populations along national borders, while drug-resistant *P. falciparum* further complicates malaria control efforts, especially in the Greater Mekong Subregion (GMS).

The *Regional Action Framework for Malaria Control and Elimination in the Western Pacific 2016–2020*, aligned with the *Global Technical Strategy for Malaria 2016–2030* and endorsed by the sixty-seventh session of the Regional Committee (WPR/RC67.R3), outlines ambitious goals to accelerate progress towards elimination. The Regional Action Framework calls for a shift in strategy by defining malaria surveillance as a core intervention and providing countries with the opportunity to develop surveillance systems that allow for achieving and sustaining elimination. An elimination-capable surveillance system is ideally web-based and able to track and classify all malaria cases and foci, ultimately to inform rapid investigation and response.

Of the 10 malaria-endemic countries in the Region, China, Malaysia and the Republic of Korea target elimination in 2020. Each of these countries has established surveillance systems to support elimination efforts, while the remaining seven countries have malaria information systems designed primarily for malaria control. GMS countries, as part of the Emergency Response to Artemisinin Resistance (ERAR), now the Mekong Malaria Elimination (MME) including Cambodia, the Lao People’s Democratic Republic and Viet Nam, have been sharing data as part of the regional data sharing platform, a flexible web-based platform to use as countries advance towards elimination. The Pacific island countries, Solomon Islands and Vanuatu, have also adopted the DHIS, while Papua New Guinea is working to strengthen its surveillance system step by step. The Philippines is implementing a subnational elimination strategy. While it has not adopted the DHIS, the Philippines is beginning to utilize a web-based platform in select provinces.

Each country monitors its malaria programme using a unique set of surveillance indicators. The Regional Action Framework includes a set of surveillance indicators to track malaria control and progress towards elimination in the Western Pacific. Each country should revisit its indicators and attempt to align with those found in the elimination framework. Also, there is a need to share information and reach consensus regarding which surveillance platform is best suited to monitor progress towards elimination at the country level and what needs to be done to strengthen non-compliant systems when transitioning from control to elimination.

WHO convened the three-day Meeting for Strengthening Surveillance of Malaria Control and Elimination in the Western Pacific Region on 21–23 June 2017 with participants from malaria programmes of the ministries of health, partners, malaria experts and the WHO Secretariat to discuss and agree on common indicators, achieve consensus on a national malaria surveillance system and develop work plans to update the proposed system. The meeting provided an opportunity to discuss the Regional Action Framework, the new malaria elimination manual, and progress towards achieving malaria-related Sustainable Development Goals.
1.2 Objectives

The objectives of the meeting were:

1. to identify country indicators that align with the *Regional Action Framework for Malaria Control and Elimination in the Western Pacific 2016–2020* and discuss how to strengthen surveillance;
2. to seek consensus on a common data platform to achieve elimination in countries; and
3. to develop national work plans and timelines for deployment of elimination-ready surveillance platforms.

1.3 Opening remarks

Dr Mark Jacobs, Director of the Division of Communicable Diseases, delivered the welcome address on behalf of Dr Shin Young-soo, WHO Regional Director for the Western Pacific. Dr Jacobs highlighted the significant progress towards regional targets achieved to date by the 10 malaria-endemic countries in the Region. Endorsement of the *Regional Action Framework for Malaria Control and Elimination in the Western Pacific 2016–2020* by the Regional Committee in 2016, the political leadership demonstrated by leaders of Asia and the Pacific and the success achieved by Member States over the past few years brought malaria elimination within reach for many Member States.

However, he cited that targets set forth in the Regional Action Framework, including a reduction of malaria mortality by 50% and morbidity by at least 30% (compared to 2015 baselines) and malaria elimination in three countries in the Region by 2020, are quite ambitious. He emphasized a key pillar to achieve these targets is malaria surveillance, which is now supported as a core intervention and critical to achieve and sustain malaria reduction and elimination. Three countries in the Western Pacific Region – China, Malaysia and the Republic of Korea – have extensive experience with case detection, case and foci investigation and classification, and response. Dr Jacobs highlighted that the shared experiences from these three countries will benefit the Region to reach its elimination targets.

Dr Jacobs emphasized the need for countries in burden reduction settings to strengthen their surveillance systems and he supported use of the DHIS as an effective tool for rapid reporting, data analysis and data sharing – nationally, regionally and globally – which has been adopted for malaria surveillance by the WHO Regional Office for the Western Pacific. He further emphasized that the inputs and shared experience from this meeting will guide the finalization of the regional surveillance platform as consensus is reached on the core set of indicators and the information system requirements to strengthen surveillance in the region.

1.4 Nomination of chair, vice-chair and rapporteur

On behalf of the Regional Director, Dr Rabindra Abeyasinghe, Coordinator, Malaria, other Vectorborne and Parasitic Diseases, WHO Regional Office for the Western Pacific, presided over the election of the officers for the meeting. Dr Sibauk Bieb, Executive Manager of Public Health, National Department of Health in Papua New Guinea, was nominated as chair. Dr Tran Thanh Duong, Director of the National Institute of Malariaology, Parasitology and Entomology, Viet Nam, was nominated as vice-chair. Dr Jenarun Jelip, Senior Principal Assistant Director of the Vector Borne Disease Control Sector, Ministry of Health, Malaysia, was nominated as rapporteur. The nominations were endorsed by all participants.
2. PROCEEDINGS

2.1 Technical session 1: Global and regional updates

2.1.1 *Malaria Surveillance, Monitoring and Evaluation: An Operational Manual*

Dr Abdisalan Noor, Team Leader, Surveillance Unit, WHO Global Malaria Programme, presented the global malaria situation and an overview of *Malaria Surveillance, Monitoring and Evaluation: An Operational Manual*. Each chapter of the manual was presented including: surveillance on the pathway to malaria elimination; establishing malaria surveillance systems; concepts and practice of malaria surveillance systems; early warning, early detection and response to malaria outbreaks; and epidemics and monitoring and evaluation of national malaria programmes (NMPs). An additional chapter on entomological surveillance is being prepared and will be integrated later.

Dr Noor highlighted key messages found throughout the manual. First, NMPs must plan surveillance actions along a continuum of malaria transmission from very high to very low, with emphasis on planning for successive steps. Given modern information and communications technology, information collection and exchange are increasingly more rapid and dynamic than previously considered possible. National programmes should leverage these technologies where possible. Second, both rapid diagnostic tests (RDTs) and light microscopy are recommended for malaria diagnosis in areas and countries that are eliminating malaria. Third, foci classification has been simplified, having three rather than seven types of foci, each with defined and adaptable intervention packages.

Eleven core principles were highlighted that define a well-designed and established malaria surveillance system:

1. integration with the national health information system;
2. accurate parasitological diagnosis;
3. national surveillance standard operating procedures should be guided by country needs and should be based on WHO recommendations;
4. regardless of the size of the malaria burden, front-line staff involved in the detection, recording and reporting of cases should also be the first users of the data;
5. surveillance systems should be able to address the subnational heterogeneity of malaria within country boundaries;
6. necessary surveillance investments and system transition should be a precursor to anticipated reduction in disease burden;
7. all surveillance data must be linked to a decision at some level of the health system, even if this decision means that no immediate changes in interventions are required;
8. across all transmission settings, concerted efforts must be made to also include cases detected in other sectors (e.g. in private and other non-governmental health providers);
9. after the interruption of transmission, surveillance for malaria may become part of a broad responsibility of the general health services;
10. as with most other health interventions, surveillance is likely to benefit from innovation and advances in technology; and
11. surveillance systems should be assessed routinely to monitor their accuracy, reliability, completeness, precision, timeliness and integrity.

Dr Noor defined an effective surveillance system, emphasizing that the system tools, procedures, people and structures required for generating information to plan, monitor and evaluate the programme are relevant for the setting and should be updated as necessary. System tools included report forms, tally sheets, registers, patient cards, computer hardware and software, documentation and training materials. The procedures to be pre-defined included case definitions, reporting frequency, pathways of information flow, data quality checks, incentive schemes, data analysis, mechanisms for review of performance, methods for disseminating results, using data for making decisions on appropriate response, supervision and planning. The people required included decision-makers both inside and outside the health service who use data from surveillance systems, the health
staff who gather or use the data, and the community whose details are registered. Furthermore, the structures included the ways that staff are organized to manage, develop and use the system.

The discussion focused on definitions of terminology used in the manual and clarification of specific situations of surveillance in malaria control and elimination settings. Particular attention was given to the term “population at risk” in elimination settings, which should be estimated based on active foci to avoid inaccurate indicator values. In an elimination setting, the absolute number of malaria cases and deaths should be monitored rather than rates or proportions. Further, as the annual parasite incidence (API) categories in the manual are based on case estimates in Africa, the values of 100 per 1000 population was noted as far too high for a low transmission classification in the Western Pacific Region, which normally observes an API of 1–10 per 1000 population.

2.1.2 Regional Action Framework: strengthening surveillance

Dr Rabindra Abeyasinghe presented technical updates on the Regional Action Framework for Malaria Control and Elimination in the Western Pacific 2016–2020 starting with a brief description of the salient points of the Global Technical Strategy for Malaria 2016–2030. The Regional Action Framework has an overall vision of a Western Pacific free of malaria. Its goals are to: (1) reduce mortality due to malaria in the region by 50%, and morbidity by at least 30%, by 2020, relative to 2015 baselines; (2) to achieve malaria elimination in three countries by 2020; and (3) to establish elimination-capable surveillance systems in countries of the GMS by 2017, and in all countries of the Region by 2020.

The third pillar of the Regional Action Framework is to transform malaria surveillance into a key intervention. Dr Abeyasinghe discussed in detail the following surveillance-related objectives, priority activities and milestones:

Surveillance

1. Establish elimination-capable surveillance systems in countries of the GMS by 2017, and in all other malaria-affected countries of the Western Pacific Region by 2020.
2. Define first-level subnational administrative units where malaria transmission has been interrupted, and prevent the re-establishment of malaria in those areas.

Priority surveillance activities at the regional level

1. Establish an elimination-capable surveillance system for malaria in all malaria-affected countries of the Region, ensure appropriate use of data for effective targeting of interventions, and ensure regular monitoring of their malaria situation.
2. Strengthen technical support to countries that have made significant progress towards malaria elimination, facilitating acceleration of elimination efforts by 2020.
3. The surveillance system may be specific for malaria, or may be a component of broader national systems for surveillance and for communicable disease control and elimination. The surveillance structure and approach will be determined by national policies and priorities, matched to their progress towards malaria elimination.

Priority surveillance activities at the country level

1. Strengthen health system components (including surveillance, procurement and supply management, and logistics management) to maximize efficiency and facilitate universal, uninterrupted access to quality assured primary and preventive care for malaria.
2. Achieve rapid reduction of transmission in highly endemic areas through targeted delivery of both proven and innovative interventions.
3. Ensure adequate uptake of interventions through sound monitoring and evaluation.
4. Local analysis may identify additional priorities.
Surveillance related milestones and targets

By end of 2017
- All countries have updated (or revalidated) their malaria strategic plans and defined targets for malaria elimination, and have included those targets in their broader national health policies and planning frameworks.
- Countries of the GMS have established case-based surveillance for elimination in all areas, including in areas with artemisinin-based combination therapy (ACT) and other drug resistance.

By end of 2018
- Each country has established a national level surveillance system that is capable of accelerating towards elimination through case-based surveillance in areas with low burden, and has substantially strengthened epidemiological surveillance in areas of high burden (including case reporting by the smallest administrative unit).

By end of 2020 (or earlier)
- Elimination-capable case-based surveillance is maintained in areas with low burden, and epidemiological surveillance continues to be enhanced in areas of higher transmission.
- No re-establishment of local transmission of malaria in first-level subnational administrative units where malaria transmission has been interrupted.

The importance of establishing an elimination-capable surveillance system was described; without this system malaria elimination will not be realized. Key actions, its implementation and the design of the system itself were also described. Investment in human resource and infrastructure for surveillance were highlighted as important backbones of the surveillance system.

The difference in malaria surveillance during control versus elimination was mentioned. In a control setting, surveillance should be part of the programme and the goal to find high-risk areas and populations. Surveillance in a control setting would be used to plan and evaluate national/regional control activity with aggregate data collected and analysed intermittently throughout the year. In an elimination setting, surveillance is the key strategy in the programme and the goal should be to find each case and foci. Surveillance in an elimination setting is used to block transmission in foci before forward transmission. Data reporting, analysis and feedback must be timely and complete.

As areas and countries achieve interruption of transmission, programmatic focus should shift to preventing reintroduction. The probability of malaria becoming re-established in a malaria-free area varies according to the focus receptivity and vulnerability. Health systems should maintain the capacity for: early diagnosis of all malaria cases through case-based surveillance and rapid response; prompt treatment of all malaria cases to prevent onward transmission and risk of death from imported malaria; and improvement of preventive practices among travellers through effective and evidence-based pre-travel health advice.

Dr Abeyasinghe noted that country malaria indicators need to align with the Regional Action Framework and the Global Technical Strategy. He reminded countries that their political leaders have signed an alliance to eliminate malaria and a strong surveillance system is a requirement to facilitate the WHO certification process, showing that there have been no indigenous malaria cases while parasitological testing was maintained. As such, a regional web-based DHIS platform has been developed to monitor monthly cases and other indicators. Countries should develop their work plans and timelines to strengthen their systems to be elimination-capable and to submit monthly data. Although the DHIS2 platform was suggested to be used in countries as a primary surveillance platform, primarily as a strong sustainable integrated platform and a means to facilitate the malaria-free certification process, there is flexibility for which platform countries use as long as they are meeting the criteria agreed.
2.1.3. Proposed malaria surveillance indicators for the Western Pacific Region

Dr James Kelley, Consultant, Malaria, other Vectorborne and Parasitic Diseases, WHO Regional Office for the Western Pacific, presented the regional indicators, integrated as part of the regional DHIS2, that were initially produced as part of the Global Technical Strategy and optimized at the regional level to align with the Regional Action Framework. He discussed that the responsibility for collecting monthly data from countries will be with the Malaria, other Vectorborne and Parasitic Diseases unit, while the Health Intelligence and Innovation (HII) unit will support maintenance of the DHIS2 system and servers, which are housed at the Regional Office and secured within its IT network. The Regional Office will be the repository for the regional malaria and vector data, including countries’ monthly data disaggregated by age (< 5, 5–14, 15+) and gender for the second administrative or district equivalent level in each country. He listed the indicators (Table 1) and data elements (Annex 1) for surveillance of burden reduction and elimination settings in the Western Pacific Region.

After introducing the regional surveillance platform, he presented the DHIS2 dashboards and data collection templates for burden reduction and elimination settings. The example dashboards were produced and consolidated based on fictional data in order to highlight that surveillance strategies will be different for various settings: burden reduction, elimination, or prevention of re-introduction. Dr Kelley noted that the countries in burden reduction settings, including Cambodia, the Lao People’s Democratic Republic, Papua New Guinea, the Philippines (phased elimination), Solomon Islands, Vanuatu and Viet Nam, should submit data for eight indicators (two impact and six outcome indicators). Elimination countries, including China, Malaysia and the Republic of Korea, should submit relevant data for 14 indicators (five impact and nine outcome indicators).

Table 1. Regional Action Framework: indicators for regional surveillance in the Western Pacific

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<tr>
<th>Outcome</th>
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<th>EL</th>
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<tr>
<td>1.1 Proportion of targeted population at risk covered by LLIN distribution (/IRS), by country</td>
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<tr>
<td>1.2 Proportion of suspected malaria cases tested with parasite-based diagnosis and, among those positive cases, proportion correctly treated, by species</td>
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<td>**</td>
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<tr>
<td>1.3 Number (and %) of targeted administrative units, by country, with API &lt;1/1000 and reporting interruption of local transmission of malaria</td>
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<tr>
<td>1.4 Number (and %) of targeted administrative units, by country, with TPR ≥5%, TPR &lt;5% and API &lt;1/1000</td>
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<tr>
<td>1.5 Number (and %) of cases reported from admin units, by country, where local transmission of malaria has been interrupted and, among those, the number and classification of locally transmitted cases of malaria</td>
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<tr>
<td>1.6 Number of countries with “elimination-capable” malaria surveillance systems</td>
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<td>1.7 Proportion of expected health facility reports received at the national level</td>
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<td>1.8 Proportion of cases investigated and classified, by country</td>
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<tr>
<td>1.9 Proportion of foci investigated and, among them, proportion classified</td>
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<td>Impact</td>
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<td>2.1 Confirmed malaria cases (number and rate)</td>
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<td>2.2 Deaths due to malaria (number and rate)</td>
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<td>2.3 Number of countries reporting zero local malaria transmission by 2020</td>
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<td>2.4 Number (and %) of cases, by classification and country</td>
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</tr>
<tr>
<td>2.5 Number (and %) of foci, by classification and country</td>
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</tr>
</tbody>
</table>

BR = burden reduction; EL = elimination;
Note: Country subnational data (admin level 2, i.e. district) by species, age group (<5, 5–14, 15+) and gender; TPR disaggregated by RDT and microscopy.

There were a number of comments about the regional DHIS2 platform. Malaysia asked about how an “elimination-capable” system is defined, how to determine the number of health facilities as a denominator and how to address the issue of imported cases (e.g. register based on place of infection or place of residence). As a response, Dr Abeyasinghe noted that an elimination capable surveillance system in its essence should report cases and what response is being taken. In order to stop
transmission, the surveillance system must have active monitoring and reporting. Regarding facilities, it is important to monitor the number of facilities that have testing capacity and, of those which are reporting; ensuring that these cases are being captured by the surveillance system.

Professor Gao Qi, Jiangsu Institute of Parasitic Diseases, noted the system is useful but asked for the purpose of collecting regional level data. If the data are to guide elimination, modifications would be required as the current proposal collects historical data. One issue raised was that case classification and the number of cases investigated necessary to be linked together, as well as the number of cases reported and the number of foci classified and investigated, which may be linked for each case. During the elimination phase, he suggested that gender and age are not necessarily needed because all cases have been responded to. Dr Abeyasinghe clarified that the regional level still must collect these data elements for countries in the burden reduction setting. The purpose of a surveillance system is to build capacity to respond, so the platform may require fine-tuning in the future based on capacity and case load. Eventually countries in burden reduction phase will be able to respond to all cases when they are ready to move towards elimination as total caseloads decrease.

Viet Nam mentioned that DHIS2 is used for integrated disease data capture but the software is not used for malaria. Dr Anh responded that WHO has been working with the Viet Nam Ministry of Health on disease integration because of its flexibility in different settings. In the Lao People’s Democratic Republic, DHIS2 is being used to capture more than seven disease programmes and modules can expand as needed. Each programme level can access and analyse data through the DHIS2 dashboards and higher levels can more rapidly support response efforts. Viet Nam noted that one challenge of their surveillance is the number of health facilities to monitor: level 2 has over 700 facilities.

Cambodia raised the challenge of calculating the population at risk for malaria and for long-lasting insecticidal net (LLIN) coverage calculation, and currently the World Malaria Report uses the same denominator to calculate both values but causes problems as LLIN targets smaller groups each year. Dr Noor responded that it is possible that the Global Malaria Programme may collect targeted population at risk for vector control and LLIN coverage going forward, so clear identification of malaria risk populations is important. The Regional Office noted that when shifting from burden reduction to elimination the key is to accurately determine who needs protection to prevent transmission. Data are critical to know the true population at risk though monitoring trends.

2.2 Technical session 2: Surveillance in burden reduction countries

2.2.1 Malaria surveillance in the Lao People’s Democratic Republic using DHIS2

Dr Bouasy Hongvanthong, Director, Center of Malariology, Parasitology and Entomology (CMPE), presented the malaria surveillance system and recent developments of the DHIS2 platform. Dr Hongvanthong noted that the current malaria information system is an aggregated, district-level, monthly, passive, paper-based platform. The main challenge has been that it can take up to 45 days for the compiled provincial case data to reach CMPE, limiting timely support to outbreaks. He shared his concerns about the quality and completeness of data being generated; the current breakdown by age (only under and over 5 years of age) and gender (captured at local level but excluded in the national database); and that data analysis is done at CMPE but not at the subnational level where local knowledge about cases would add important information.

Dr Hongvanthong then presented the programme’s web-based DHIS2 reporting tool, which has allowed for faster case reporting, and improved data completeness and accuracy in efforts to plan effective interventions. The system has been linked to mapping data to allow for real-time spatial analysis and identification of sources of infection. As surveillance moves from being part of monitoring and evaluation to a primary component of elimination, efforts are being made to identify foci and record commodity stockpiles. He outlined the steps CMPE took with district-level leaders to establish and roll out DHIS2, including establishment of a DHIS2 working group and DHIS2
academy training countrywide in 2016. Moving forward, CMPE will work to connect subdistrict facilities and roll out case-based tracking; standardize reporting forms and reporting periods, and generate and disseminate reports and coordinate with stakeholders for information sharing. The key challenges for CMPE include human resource capacity, how to use data for decision making at all levels (especially subnational level) and how to best coordinate partners around the national strategic plan.

Dr Abeyasinghe noted that many health facilities do not report data, so one strategy should be strengthening levels in a cascading manner, from upper levels to lower levels and have the upper levels train lower levels through a step-by-step process. Cambodia noted that where malaria burden is high, reporting is often delayed. However, efforts to start monthly submission should be ongoing, while low-burden areas can submit weekly. Professor Gao Qi noted that it is important to consider the quality of data collection and the data collection process, possibly using a mobile phone or laptop depending on the malaria burden or human resources situation. There is need to be flexible and to consider the true burden to determine steps to take next.

2.2.2 Malaria surveillance in Papua New Guinea: challenges, lessons learnt and a way forward

The delegation from Papua New Guinea presented its national malaria surveillance system. Since 2012, Papua New Guinea has worked to improve reporting of parasitological confirmed cases while minimizing reporting of clinical malaria. In 2012, over 80% of reported cases were clinical malaria, while in 2016 almost 80% of cases were confirmed by RDT or microscopy, indicating a significant improvement. The surveillance and data quality challenges have included high malaria burden combined with a lack of human resource capacity, paper-based reporting, funding limitations and lack of quality training, delays or lack of data reporting from the facilities, and lack of private sector reporting and integration. The focus for the National Malaria Control Programme has been to: test all malaria-suspected cases and treat correctly; register and record all cases correctly and consistently; keep the facility list up to date and ensure timely and complete data reporting; and analyse data, provide feedback and take action.

The discussion surrounded how to ensure that the number of people tested and treated was correctly recorded and reported. The current surveillance systems in Papua New Guinea have not been able track tested patients very well. The new electronic system, however, should improve this system. One of the challenges raised by the programme was to accurately account for positive cases though quality microscopy. To do so, the programme should determine the workload of microscopist based on the number of cases and tests being conducted in the area. Currently, clinicians are not very confident about relying on RDT results for confirmation, which in some cases is more sensitive than microscopy.

2.2.3. Experience increasing health facility reporting rates in Solomon Islands using DHIS2

Dr Albino Bobogare, Programme Director, Solomon Islands National Malaria Control Program, presented the national malaria DHIS2, which is part of an integrated national health information system with data from multiple disease programmes uploaded at the provincial level. All treated malaria cases are reported monthly through DHIS2. The current platform was operationalized in 2016, and now more than 80% of health facilities are submitting data through the online platform. Although not yet integrated into the DHIS2, the stock status of malaria commodities is planned for 2018. The current system allows for improved data coverage and quality, generation of core programme indicators and stratification to the village level. It is a useful platform to build a malaria elimination module for case and foci classification and monitoring, and as a reference tool for elimination verification and certification.

Some challenges with the web-based platform include intermittent internet connectivity, high workload in some provinces, delays in data flows into the system and capacity at the provincial level.
New content will be developed to address the information needs of the programme including an elimination-related information package of key indicators, standard operating procedures for case and foci investigation and classification, and routine periodic monitoring of insecticide resistance and therapeutic efficacy data. The discussion highlighted that the DHIS2 surveillance system adopted in Solomon Islands has resulted in an improved process with more accurate accounting of the number of cases. The fact that cases increased in 2016 may be partially due to improved surveillance.

The discussion shifted to the practical and ease of using DHIS2. The Lao People’s Democratic Republic shared their experience and the importance of training staff at the lowest level in order to maintain full adoption and motivation in the districts.

2.3 Technical session 3: Surveillance in countries transitioning towards elimination

2.3.1 Experience using DHIS2 Tracker for malaria case-based reporting and case investigation

Dr Siv Sovannaroth, National Center for Parasitology, Entomology and Malaria Control (CNM), Cambodia, presented on transitioning to elimination through enhanced surveillance and targeted response. The National Strategic Plan for Elimination of Malaria in the Kingdom of Cambodia, 2011-2025, endorsed by the Prime Minister, set out the following goals: eliminate *P. falciparum* by 2020 and eliminate all malaria by 2025. However, the current malaria surveillance system is complex. The primary challenge is that CNM, provincial health districts, and operational districts cannot respond to cases quickly enough to provide adequate response; the health information and malaria information systems (MIS) tend to be duplicative for health-care workers. Also, there are different systems for different points of care (e.g. heath facilities, village malaria workers (VMW), public–private mix (PPM) and military), which in turn makes data consistency and validation difficult. Village malaria workers rely on funding from the Global Fund to host monthly meetings to submit data. Partners provide diagnosis and treatment services using their own systems, leading to fragmented reporting. Moreover, CNM access to the malaria information system is limited to one person at a time.

Under the new system, data from febrile patients who visit the local care providers will be entered in the online register either via tablet (health facility) or mobile phone (village malaria worker/public–private mix) and directly uploaded into the malaria information system. All management levels (provincial health district, operational district and CNM) have online access to the malaria information system and are able to review information from any case, allowing for feedback and response. The malaria information system triggers a follow-up request to staff at the specific health facility or in the village where the case resides, to gather more information. Active surveillance activities can then take place at the community level in elimination-targeted operational districts. This includes case investigation, case detection and foci investigation. All information related to the case will be looped back into the system. Using the results from passive and active surveillance, a response can be planned to stop transmission, including vector control, mass drug administration or increased case detection activities. However, these are new activities for CNM and the Ministry of Health and will require a considerable number of dedicated staff for the system to function effectively.

The DHIS2 and Case Tracker pilot in Battambang strives to enable immediate case reporting or notification from facility level to district, provincial and national levels for systematic case investigation and response while minimizing paper-based reporting and data errors. To date, the DHIS2 includes standard data elements and indicators, standard operating procedures for data flow and operations, customization of the DHIS2 Android Tracker Capture, and procurement of Android tablets. Trainings were conducted by WHO and CNM in 15 health facilities, 2 provincial health districts and 2 operational districts, and for 38 village malaria workers and 2 public–private mix health-care providers. Monthly data validation and supervisory visits have been ongoing and support provided for select case investigations. Foci mapping has been initiated. A mid-2017 external assessment reported that health staff were able to immediately store and transmit data with higher
precision and without additional paperwork. Staff demonstrated implementation of the malaria surveillance standard operating procedure. However, some inconsistencies were noted about accuracy of data entry, and in areas that did not receive monthly supervision, lower reporting completeness and validation of few data elements.

During discussions, Dr Abeyasinghe addressed a question about the alignment of the DHIS2 with the Sustainable Development Goals (SDGs), noting that the global, regional and national indicators are fully aligned with the SDGs and that the DHIS2 is flexible enough to link with other non-DHIS2 systems, given some technical support. Dr Siv noted that in order to scale up the DHIS2 and online malaria information system, staff capacity needs to increase in the facilities and that donors may provide this support.

2.3.2 Malaria surveillance in the context of a phased elimination approach: Philippines

Dr Raffy Deray, Program Manager, National Malaria Control and Elimination Program, Disease Prevention and Control Bureau, Department of Health, announced that the Government of the Philippines has designated malaria as a notifiable disease. He presented an update of the national transition from control to elimination. Recent data trends from 2010 to 2016 show a significant increase in the number of provinces having no malaria cases. This uptrend emphasizes the need for a robust surveillance system to ensure all suspect cases are immediately detected, confirmed, treated, notified and investigated. He presented the national malaria surveillance response strategy, detailing the flow of data and standard operating procedures for elimination and the online malaria information system (OLMIS) that is being used to support the elimination strategy of the malaria programme. The online system consists of a back-end database with case, foci and laboratory registries, case and foci investigation forms, vector surveillance monitoring data, and logistics management. There is also a portal for case management and the National Malaria Control and Elimination Program website. Discussion also covered the elimination response hub, which is a designated area where all supplies and commodities are stored for response initiatives and which requires at least human resources and commodities for malaria case detection and management and entomological activities.

Viet Nam made a comment asking how the online malaria information system is used to ensure prompt reporting. Dr Deray responded that the system is primarily implemented in areas where caseload is low and therefore manageable. The Malaria Consortium congratulated the Philippines for making malaria a notifiable disease and asked to share experience in this process. It was agreed to by the Department of Health, but Dr Deray clarified that this is only in areas where caseload is low, making implementation more feasible.

2.3.3 Experience initiating DHIS2 for malaria surveillance in Vanuatu

The national malaria programme of Vanuatu presented their experience initiating the DHIS2 for malaria surveillance in areas of burden reduction towards elimination. The goal of the Vector Borne Disease Program is to effectively control malaria in four provinces and strive for elimination in two provinces. To facilitate these objectives, they have updated their surveillance system technologies from Microsoft Excel to Microsoft Access and as of October 2016 to the DHIS2. The programme plans to expand the role of the malaria information system to: include a routine monthly malaria line list and event-based data in all provinces; have an elimination DHIS Tracker database in elimination provinces; and utilize the DHIS2 to track LLIN distribution using a compatible mobile application. The programme has now designed, developed, tested, assessed and imported historical data into the DHIS2, and it is now undergoing training for provincial staff to use the DHIS2 for data entry and decision-making. The next step is to integrate the malaria DHIS2 module into the national health information system before the end of 2017. To roll out the Tracker database, the programme will undergo intensive training and system testing in early 2018. The primary challenges noted include internet and IT resources, human capacity and aligning DHIS2 versions with the national health information system before integration.
There were comments from the Lao People’s Democratic Republic programme highlighting the lack of IT capacity to maintain systems on the long term. Both internet and human resource capacities must be maintained. The key is to utilize capacities across the national level, which is why integration is important. Sustainable systems can be accomplished as the Ministry of Health advocates capacities in other health units or ministries, looking within to support malaria solutions.

2.3.4 Malaria surveillance in Viet Nam including insecticide resistance monitoring

The delegation from the National Institute of Malariology, Parasitology and Entomology (NIMPE) of Viet Nam presented an overview of the malaria surveillance system starting with the national context, current strategies and interventions, country progress, strategies for elimination, challenges to scaling up elimination, and programme needs and priorities. After outlining the goals, objectives and interventions of the national strategic plan for 2011–2020, NIMPE detailed the national surveillance system including the data flow from lower levels to the Ministry of Health using paper-based reporting and weekly and monthly email reporting.

Malaria surveillance needs and priorities were listed, including the need to develop real-time case reporting from village and commune levels, initiation and expansion of routine active case investigation to classify cases, improving tracking and follow-up of mobile and migrant populations, increasing cross-border data sharing to inform interventions, initiating routine reactive case detection in low-endemic areas, exploring the use of proactive case detection to reduce the parasite reservoir in higher transmission areas, integrating case data with other data (entomology, climate, environment) to improve foci investigation, and developing mapping capacity within NIMPE, regional malariology institutes and provincial/district offices.

The discussion began with the ability of surveillance systems to track individual repeat cases, an issue related more to elimination areas that are using a case tracker system. Avoiding repeated cases requires a unique identifier to be tagged to the individual case, which is not being done. Some countries are considering using fingerprint or national identification cards, but these approaches have not been working well to date, particularly in mobile migrant areas or in underage groups. Case-based elimination countries are tracking cases but most likely many vivax malaria cases are relapses and are not being detected as such. Adequate services and supplies for border areas must be ensured through surveillance.

The Republic of Korea noted that patient data are identified as duplicate when patients visit more than one hospital; but social security numbers are given to track patients. The Malaria Consortium highlighted the need to emphasize feedback for action and clear strategies that provide concrete responses down to the community level.

2.4 Technical session 4: Clarifying surveillance on the pathway to elimination

2.4.1 A framework for malaria elimination

Dr Noor presented an overview of the new Global Malaria Programme publication A Framework for Malaria Elimination, which is a 2017 update of the 2007 publication Malaria Elimination: A Field Manual for Low and Moderate Endemic Countries. The framework is in line with the Global Technical Strategy and fits within its three pillars and supporting elements. The presentation highlighted the manual development process, including wide consultation and regional meetings beginning July 2015 at the first elimination review group meeting in New Delhi. A number of updates to the 2007 publication were highlighted including:

- All malaria-endemic countries are included in the new framework and it highlights actions across the continuum of transmission from high to very low/zero.
- Elimination feasibility is replaced by critical requirements to achieve and maintain elimination.
- There is a critical role of information systems and surveillance as an intervention.
- RDTs and light microscopy are recommended for malaria diagnosis.
- There is a simplified focus classification scheme.
- Updated strategies for different transmission intensities such as mass drug administration.
- There is an emphasis on verification and certification of malaria and a clarified threshold for re-establishment of transmission.

Dr Noor presented the content of the framework, clarifying WHO malaria terminology, defining malaria elimination and certification of elimination, and providing updated strategies. He noted that subnational verification is an option for countries that have interrupted local transmission in parts of their territories, and documentation should be as rigorous as the national certification process and assessment procedures. While WHO at all levels provides technical guidance, monitors progress and resolves bottlenecks, Dr Noor emphasized that elimination is country-owned and country-driven.

### 2.4.2 Case classification and foci classification

Dr Abeyasinghe presented definitions and concepts surrounding malaria case and foci classification. He emphasized the importance of using a diagnostic test to confirm and accurately identify all suspected malaria cases and to reveal asymptomatic cases. Targeted acceleration of active case detection is important when countries transition from burden reduction to elimination. It is important to improve reporting the number of patients tested. As the programme focuses on reducing falciparum and vivax malaria, other species will decline; but if *P. malariae* cases exist, it means the vector control efforts have failed, as the vector must survive much longer for *P. malariae* transmission to occur. He discussed case classification as an important issue to determine indigenous cases or imported cases, either from another area or another country. It is important to clearly define imported cases for each setting. For subnational verification, it is important to identify the areas in which cases were infected, which may be different from the site of diagnosis or usual residence. Elimination is about getting rid of the parasite, not the vector. Dr Abeyasinghe also defined: re-introduction of malaria as more than three indigenous cases for three consecutive years; and a focus as requiring conditions of transmission, classified as active, residual non-active and cleared up.

Comments were made about the importance of maintaining slide banks and quality assurance systems for microscopy. As burden declines and health facilities have no cases for long intervals, microscopy quality maintenance becomes a challenge. As such, it is important to have a national or regional slide bank to provide practice for microscopists in order to maintain confidence and skill. Cambodia commented that the costs and capacity to maintain microscopy nationwide is not feasible, so the programme relies on RDT as the primary tool for testing. Dr Abeyasinghe noted that reference microscopy sites are needed as RDTs alone may not be completely effective, primarily due to challenges for vivax detection and possible complications resulting from histidine-rich protein 2 (HRP2) deletion.

### 2.4.3 An update on the World Malaria Report 2017

Mr Ryan Williams, Global Malaria Programme, presented an overview of the World Malaria Report data collection process and country submission update. Initially, countries complete the online forms (implemented using the DHIS2 platform), which should be approved by the WHO national programme officer or validator. The approved form is then reviewed by the WHO Regional Office focal point who can provide feedback or make requests back to the country office before validating the form. The regionally approved form is then forwarded to the Global Malaria Programme for validation and feedback. This cycle begins in March each year when the online form and database are opened. The deadline for form completion is the end of June and the database is closed at the end of August to ensure that the Global Malaria Programme has time to analyse results and produce the report. In addition to completing the online DHIS2 form, countries submit a subnational datasheet and mapping shapefiles. The DHIS2 platform has the added advantage of allowing users to comment and provide feedback on the online form, creating a data audit trail.
Regional and country profiles and annexes are generated and returned to countries for review. One challenge has been with the subnational data and shapefiles alignment, sometimes creating null data or data entry errors. Mr Williams also presented a data submission and status update. New to the data submission process for 2017 was that public and private sector data were requested as well as information on mass drug administration, foci for elimination and reporting completeness. A comment was made about how to report some denominators, particularly the number of expected facilities submitting reports. It was noted by a number of countries that this is a challenge, particularly Cambodia who reports operational districts.

2.4.4 DHIS2 for malaria surveillance in burden reduction and elimination settings

Dr Hong Anh Chu, Technical Officer, Health Intelligence and Innovation (HII) Unit, Lao People’s Democratic Republic, presented on rolling out the DHIS2 and use of integrated information in the country as a system approach. A priority area of the country’s health sector reform is to strengthen health information systems with the goal of reaching universal health coverage (UHC) by 2025. To achieve this, the health sector has three phases of implementation, including roll out of the web-based DHIS2 platform. Key to its success is leadership, legislation and coordination; internet connectivity and system configuration; technical capacity at all levels; and financial sustainability.

The current health information system/DHIS2 platform in the Lao People’s Democratic Republic is integrated to collect monthly aggregate data for maternal child health, the Expanded Programme on Immunization (EPI), nutrition, outpatient/inpatient data, malaria, and HIV and sexually transmitted infections (STI) units. Event-based case data collection is underway for malaria, HIV+/AIDS and sexually transmitted infections; quarterly aggregate data are collected for human resources, tuberculosis (TB), infrastructure logistics and donor reports; and annual data are collected for maternal, neonatal and child health as well as health sector monitoring and evaluation, and universal health coverage and SDGs. The advantages of the DHIS2 include: all users can access the platform securely, the reporting timeframe can be set to meet data needs, and managers can see the big picture as well as analyse specific interests and retrieve tailored summary reports. Although the integrated health information system in the Lao People’s Democratic Republic is in its early stages, use of data at all levels is encouraged to strengthen the system and sustainability. Quality data and reporting compliance can only be achieved if the reporting system is consistently used and improved upon.

2.4.5 Improving private sector malaria case surveillance and quality assurance using DHIS2

Ms Lorina McAdam, Greater Mekong Subregion Malaria Elimination Program, Population Services International, presented the challenges, tools and lessons learnt during efforts to strengthen the private sector’s contribution to malaria surveillance in the GMS. The key challenges have been to generate timely and robust private sector malaria data, making reporting and quality assurance simpler and faster and help people effectively use data for decision-making and action. In the GMS, there are an estimated 22,000 private sector providers working with PSI, and Population Services International seeks to ensure that malaria surveillance data is available to national malaria control programmes in a timely manner. The GMS programme supports the development of two tools: a phone-based malaria case surveillance application and a tablet-based health network quality improvement system, both that feed directly into the national DHIS2 platform as soon as data are entered. Both applications are simple and easy to use. Once data are fed into the DHIS2 platform, they can be used as needed and integrated into the national malaria control programme data to produce bulletins or enhanced interpretation features on the DHIS2 for decision-making.

The discussions surrounded mechanisms for implementing the applications. Solomon Islands addressed the idea that legislation for private sector participation was necessary to successfully fit into the malaria strategic framework efforts. Population Services International commented that their strategy was to initially map all possible private sector outlets and then approach them to request their participation, given the incentive of free commodities. Others commented that it is important to integrate private sector data into the DHIS2 reporting form or have some mechanism to enter data.
immediately into the national database. Papua New Guinea addressed their need to develop a policy to make the private sector accountable.

2.5 Technical session 5: Surveillance in countries targeting elimination by 2020

2.5.1 Malaria surveillance in an elimination setting: China’s 1-3-7 Strategy and the importance of timely response

Professor Gao Qi, Temporary Advisor, presented China’s efforts to integrate malaria surveillance and response as a core intervention in malaria elimination through strengthening case diagnosis, treatment and reporting; case investigation and classification and foci investigation and response. He highlighted a number of key points for each area of surveillance.

*Case finding*

All malaria suspected cases should be confirmed by RDT or microscopy before taking antimalarial drugs; lab-confirmed cases need to be timely reported.

*Case investigation and classification*

All reported cases need to be reconfirmed by microscopy or polymerase chain reaction (PCR) and all confirmed cases timely investigated.

*Foci investigation and response*

Foci investigation is to find more evidence for case classification, to confirm whether foci have local transmission and find evidence for activities that can be used to stop transmission in foci. Foci investigation activities include data collection as part of reactive parasitological and entomological surveys.

The aim of foci response is to block foci transmission within two weeks, clearing the parasite carrier and killing positive mosquitoes. The activities of foci response may include mass drug administration, indoor residual spraying or LLIN distribution, and health education and promotion. In support of these efforts, the laboratory diagnostic system must be working well including microscopy coverage in major hospitals, RDT coverage with clinics in rural areas, case transfer mechanisms, and sustaining reference lab network quality assurance/control (QA/QC) mechanisms. Also the information and response system should provide nationwide coverage for case reporting with all hospitals/clinics and have a mechanism for data analysis and daily feedback of cases.

The 1-3-7 strategy of elimination in China states that: within 1 day, all suspected fever cases are clinically confirmed and reported through the national case reporting system; within 3 days, cases are lab re-confirmed and case investigation and classification for all confirmed cases as imported or local; and within 7 days, focus investigation determines classification and response is completed. Key to this process is having the hospitals and county response team actively involved at each step as well as having a malaria reference laboratory with microscopy and molecular PCR capabilities for timely confirmation. The web-based malaria case management system is also highly optimized to meet the requirements of the 1-3-7 strategy as it is being used at the lowest levels in the country, allowing for immediate case reporting.

2.5.2 Experience with malaria case investigation and response: Malaysia

Dr Jenarun Jelip, Senior Principal Assistant Director, Vector Borne Disease Control Sector, Ministry of Health, presented Malaysia’s experience with malaria case investigation and response, outlining the malaria diagnostic approach, epidemiological investigation and contact investigation, and case-based response. Malaysia utilizes microscopy and PCR for passive, active and reactive case detection. The programme implements a 1-3-7-42 day approach to surveillance: case notification in 1 day, case investigation and registration in 1–3 days, complete vector control activities in 7 days, and outbreak control in 42 days. The malaria programme utilizes three web-based surveillance tools: e-notification,
Dr Jenarun presented the typical workflows for diagnosis and classification of malaria, with particular attention to PCR and quality control for zoonotic malaria, and differentiating between indigenous and imported human malaria.

Malaria has been a notifiable disease in Malaysia since 2010. The e-notification and eVEKPRO systems serve as a case registry, outbreak registry, vector control and malaria death registry. The software allows for spatial mapping and differentiation of imported and indigenous cases. The elimination efforts in Malaysia have been reorienting towards the elimination phase, striving for elimination and WHO certification by 2020. The national malaria programme is conducting foci investigation, data collection for demographics, mapping, insecticide monitoring, case and entomological data, and foci classification for receptivity, vulnerability and risk of introduction assessment. The MyFoci software allows for consolidation of data around a number of data elements that provide provincial and national managers with higher-level reports in real time.

Dr Abeyasinghe noted that the three eliminating countries in the region demonstrated good examples of actively adopting changes in regulations, guidelines and protocols, adding flexibility of their systems to change as the need changes.

2.5.3 Experience with malaria case investigation and response: China

The China delegation presented updates on the malaria situation and surveillance system and highlighted aspects of the 1-3-7 surveillance model. Generally, while the number of imported *P. falciparum* cases diagnosed in 2016 in China is distributed across the country, indigenous cases are found only in distinct foci in Yunnan province. Legislation requires that malaria be reported as a notifiable disease and managed through the township-based real-time online reporting platform. The case-based system includes concerted efforts from the Chinese Centre for Disease Control and Prevention (China CDC), as well as county and township hospitals. Key to the system’s success is quality control mechanisms to ensure timely and accurate data collection and the ability to produce real-time reports with maps as needed. Progress made for the 1-3-7 indicators in 2016 include: 100% of the cases reported within 1 day; 99.7% of cases received a parasitological test and 99.5% of cases were confirmed; 98.4% of cases were investigated within 3 days; and 2443 foci were investigated within 7 days. Experiences shared included the importance of legislation and mandatory reporting, the ease of the system with minimal but essential messages, a unified system with applications appropriate for full use, and timely feedback and frequent training and assessment for quality reporting at all levels. Challenges to the programme included issues surrounding case importation and case detection capacity management.

2.5.4 Response to vivax malaria cases: Republic of Korea

The delegation from the Republic of Korea presented on the status of malaria, the current surveillance and response system, and challenges and planned strategies for elimination. From the early 1990s to 2007, indigenous malaria was steadily rising, peaking in 2001 with 2488 domestic cases. Following this, the malaria programme entered the pre-elimination and elimination phases from 2007 to 2011. Almost all confirmed cases were reported in the northernmost provinces along the demilitarized zone, where approximately 50% of total cases are discharged or active soldiers. The web-based surveillance system was designed to report cases from private and public health centres through the provincial department of health to the Division of Infectious Disease Surveillance of the Korea Centers for Disease Control and Prevention (KCDC), which are responsible for investigating treatment completeness, malaria control and education, and sharing data with the Division of Vector Analysis, which is responsible for vector control and parasite species analysis. When cases are found in the military, the intention is for data to be shared and immediately entered by the public health centre into the web-based surveillance system. The key challenges identified by the programme include transforming the national goals into local level or foci strategies, reinforcing management of malaria and assessing the programme by foci based on epidemiological data. Additional challenges include
cooperation with the military defence sector with vector surveillance, data sharing, prophylaxis compliance and health education.

The strategy for malaria elimination is to achieve at minimum a 10% decrease in cases annually, while changing the definition and subdividing former risk areas to include foci, applying local level case detection for all malaria infections including asymptomatic cases though active surveillance. Comments surrounded the importance and difficulty of controlling and eliminating vivax malaria. It is critical to maintain compliance for primaquine, including point of care testing for glucose-6-phosphate dehydrogenase (G6PD) deficiency. It is important to find local transmission and target this with chemoprophylaxis during elimination efforts. Tafenoquine initial reports are encouraging for an effective single dose treatment, but it does not reduce the risk of haemolysis due to G6PD deficiency.

2.6 Technical session 6: WHO global and regional malaria surveillance databases

2.6.1 DHIS2 Data Tracker for malaria surveillance in an elimination setting

Professor Jorn Braa, Temporary Advisor, Research Group for Information Systems, University of Oslo, and his team presented about integrating systems and health programmes with the DHIS2 and provided country examples of how the DHIS2 Tracker is being used in Africa and the Western Pacific Region. Dr Braa detailed the Health Information Systems Programme (HISP), noting that it is a global, open source software network for education and research. The DHIS2, the software component, allows for reporting, analysis and dissemination of health data and tracking individuals. The DHIS2 started in South Africa in the 1990s and has now spread to over 50 countries. The Global Fund supports country implementation of the DHIS2, and Health Information Systems Programme partners with WHO, the Global Fund, Gavi and the United Nations Children’s Fund (UNICEF).

Professor Braa presented an example from the Indonesian system about the process of getting data into the DHIS2 (data warehousing) and getting data out through dashboards for decision support (business intelligence). Data warehousing comprises data captured from paper-based forms, Excel sheets, mobile devices and other programme data that are extracted, transformed and loaded into the warehouse. Once entered, data can be used for visualization on various tools such as web portals, dashboards, graphs and maps. Data from the malaria programme can be analysed and displayed for decision-making. Health facility codes are very important for integrating programmes into a single DHIS2 system, including human resources, TB, HIV/AIDS, immunization and so on.

An example from Zimbabwe illustrated how data flows from paper and electronic forms at the health facility and when entered into the DHIS2 notify rural village workers on mobile devices to follow up and investigate cases. The data officers at the district level review and approve the data which are aggregated at provinces and used by the national malaria control programme as well partners and donors. The Vanuatu DHIS2 was also discussed, which was developed from the start as an event-based register, which is simpler to maintain but has taken a significant amount of time to implement a standard process and integrate with older Access-based malaria information systems.

The discussion focused on how to link other malaria information system platforms with the DHIS2 so as to use the dashboards and analysis tools from the software. This would work from the field on tablets or mobile phones by sending structured SMS data into a gateway programmed to automatically enter data into the DHIS2 back-end database. The data elements for this type of application should be kept very simple, and health workers would require training on exact data structure entry on mobile phones. Another discussion point was that even though now it is not possible to generate maps offline, a prototype is under way.

2.6.2 Health intelligence in the Western Pacific Region: the importance of organizational units and shapefiles to improve integration using DHIS2
Dr Jun Gao, Coordinator, HII, WHO Regional Office for the Western Pacific, presented information integration of malaria data with other programmes, ideal institutional arrangements for better integration and response, and proper tools to allow for improved information sharing and response. The Regional Action Framework identifies the information needs for malaria control and elimination as universal health coverage, being able to identify all targeted people as well as information exchange and sharing with other sectors; vulnerable populations as data collected from different channels, applications (mobile) and communities; and surveillance and response as case-based reporting, quick information sharing, and actions from different parties (disease control, treatment, etc.). Ideal institutional arrangements need to assure information sharing and exchange within specific disease intervention and outside disease programmes; while proper tools link with other information systems such as national health information, logistics and hospital information systems. As noted, the primary advantages of the DHIS2 include web-based data reporting and sharing, improved functions that can handle aggregated statistics and individual data, and improved information presentation functions and geographic information system (GIS) applications (such as maps).

2.7 Technical session 7: Clarifying components of malaria surveillance

2.7.1 Surveillance for the prevention of malaria reintroduction

Dr Abeyasinghe presented various key concepts surrounding surveillance to prevent reestablishment of malaria transmission in malaria-free countries, including the importance, the process and priorities in post-elimination surveillance. He emphasized the importance of passive and active case detection through screening for fever with a parasite-based diagnostic test, RDT or microscopy. He also discussed the importance of case investigation as being the collection of information to allow classification of a malaria case by origin of infection (imported, indigenous, induced, introduced, relapsing or recrudescent), with a view to implement an epidemiological response. Case investigation may include administration of a standardized questionnaire to a malaria case and also the screening and testing of people living in the same household or surrounding areas. Factors to consider in determining case classification include travel history, parasite species, probability of local transmission in the area of residence and work of the patient, and the extent and quality of surveillance. Key priorities in post-elimination surveillance include capacity for diagnosis, clinical management including access to treatments, entomological surveillance, case investigations and response capacity.

The discussion surrounded the concept and definition of imported cases and foci receptivity. Viet Nam was concerned about when to classify a confirmed case as imported. Dr Abeyasinghe clarified that in burden reduction areas, importation is not as critical as in elimination settings. Malaysia noted that it is measuring all localities to determine receptivity by vector monitoring before classifying foci. The Republic of Korea asked if active case detection and vector control should be conducted in areas where imported cases are found. Dr Abeyasinghe noted that active case detection should be conducted for all cases including imported cases to determine possibility of secondary transmission and ensure that such transmission does not occur.

2.7.2 Monitoring drug and insecticide resistance in the Western Pacific Region

Malaria surveillance needs to include entomological indicators and insecticide resistance monitoring (IRM). These data are included in the World Malaria Report and for in-country programme management. Dr Abeyasinghe presented IRM data submitted to the Regional Office, demonstrating susceptibility of malaria vectors in the region to insecticides. The challenge in the Western Pacific Region is dealing with over 20 different vectors whose bionomic and susceptibilities are different. Continued efforts are required to understand how to best combat these vectors. For therapeutic efficacy monitoring, the global database is updated three times a year and is accessible for public viewing. As the Regional Office considers the setting up of the Regional Database, this will need to include data from monitoring of insecticide susceptibility and antimalarial resistance.
2.8 Technical session 8: Consensus-building for national surveillance platforms

2.8.1 Consensus-building for regional indicators and data submission

Dr Kelley introduced the regional level indicators and data elements, asking each delegation to identify indicators or data elements not feasible for reporting to the Regional Office. Cambodia commented on the definition of an elimination-capable surveillance system as the ability of capturing all cases and testing positives. Differentiation of local and imported cases will be done when capacity allows and is part of the overall strength of the surveillance system. Dr Noor emphasized the importance of sex and age disaggregation for epidemiological planning. Disaggregation of cases by microscopy and RDT is important. Also important is to report species by RDT and microscopy, and since data is available, the country can send these to the Regional Office.

The Lao People’s Democratic Republic commented that they have age disaggregation under and over 5 but not over 15 years of age. Papua New Guinea had a problem with collecting data on LLIN distribution and population at risk. Dr Noor responded that it is better to report populations in areas of transmission. The Philippines does not collect health facilities reporting at the national level and does not collect inpatient malaria cases. Moreover, disaggregation is difficult by age – only under and over 15 years of age. Routine reporting must be supported if the system will be upgraded and implemented. Solomon Islands does not collect data on *P. knowlesi*, *P. ovale* and *P. malariae*. Vanuatu only disaggregates by age for under and over 5 years of age. Viet Nam is having trouble scaling up testing with RDTs and submitting test positivity rates. The data element for number tested positive by RDT is not complete as only 29 provinces funded by the Global Fund and 16 funded by the Regional Artemisinin-resistance Initiative (RAI) test using RDTs. The remaining provinces, however, do not test using RDTs. Dr Abeyasinghe noted that WHO guidelines state that confirmation of *P. knowlesi* can only be done using nucleic acid amplification testing, and cannot be done using microscopy.

Eliminating countries commented on indicators and data elements. The delegation from China noted that some indicators are not useful at the current stage of control. For example annual parasite incidence and test positivity rate are not relevant, nor the proportion of population at risk protected by LLIN and indoor residual spraying. Also, the number of expected health facilities to report is questionable in elimination. One issue raised for China was that in the south of Yunnan, RDT is confirmed by microscopy which may lead to case duplication. In addition, RDT quality control is a problem; now in areas in the south, when RDT is used solely, the health workers are asked to make a slide to check when possible. Malaysia noted that RDTs are not used, so only microscopy is reported. Malaysia also had an issue reporting foci investigation and classification, such as transitioning to residual non-active foci to active foci. Dr Abeyasinghe noted that foci investigation methods and standards need to be specified at the national level. The Republic of Korea noted that foci are not yet being classified, so data elements related to foci cannot be reported.

Dr Kelley discussed the next steps to initiate the regional data platform. The immediate step is for countries to submit data on the regional annual and monthly data entry template forms including 2015–2016 subnational data disaggregated by age and gender. Second, the data will be used to create regional and national level dashboards for burden reduction and elimination countries that can be accessed by countries to analyse data as needed. And third is to generate reports and bulletins for regional and national surveillance monitoring and follow-up.

The delegations uploaded national data and explored the DHIS2 platform in an interactive session.

2.8.2 Development of national timeline to deploy an elimination-ready platform

Dr Abeyasinghe presented aspects of the Regional Action Framework that highlight the timeline and action plan for national programmes to establish elimination-ready malaria surveillance platforms. In some countries, data elements may need to be revised, particularly the number of people being tested and disaggregation of age groups and gender, which may take time to integrate into the platform. The
Regional Office would like to assess the process of data collection and may need to support data validation and establishment of appropriate web-based platforms in each country. There are three scenarios for data submission to the Regional Office: (1) countries with the DHIS2, (2) countries that do not have the DHIS2 and (3) countries with limited surveillance capabilities. For countries that have the DHIS2, the Regional Office would like to link the platform with the regional DHIS2 to actively push data to the Regional Office on a monthly basis. Ideally the effort required to submit data by linking the DHIS2 platforms can be minimized. For countries without the DHIS2, the Regional Office will support ways to automate the process as best as possible. However, for initial submission of 2015–2016 data, a more laborious process may be required by staff at national programmes. For now, the Regional Office would like to clarify and understand a feasible timeline for countries to share information on a monthly basis.

**Burden reduction countries**

- Cambodia: A web-based system is being used and plans include creating a dashboard in the web-based system that will be available to partners and the public. Data will be uploaded into system with regional support. Ideally by the end of 2017, the Regional Office will be able to retrieve data.
- Lao People’s Democratic Republic: CMPE can begin submitting data before the end of 2017.
- Papua New Guinea: As the current malaria information system is a new platform, the national programme needs to see how to put together a strategy for reporting data. Accuracy must be considered and the programme needs to discuss with colleagues, but data submission is likely to happen by the end of 2018.
- Philippines: The national programme must discuss a data submission timeline with provincial leaders. Data are not regularly submitted so there may be a delay in sharing; the date depends on the implementation of the system.
- Solomon Islands: The national programme is currently transitioning its platform, so time is needed to validate and correct data. A response from management is needed before committing to a firm deadline. The programme will follow up with the Regional Office.
- Vanuatu: The national programme has been using the DHIS2 for six months and should be able to provide monthly disaggregated data by the end of 2017.
- Viet Nam: Discussion is necessary with the national programme but it should be able to submit data by the first quarter of 2018.

**Elimination countries**

- China: The scope of some reporting units is not clear to the programme. If reporting only data from Yunnan province, the request if feasible by the end of 2017. However, if all provinces of China should submit data, the task is much more difficult as some indicators are different and no longer being used. Dr Abeyasinghe responded that for Regional Office monitoring of progress, the number of indigenous cases reported monthly is adequate. Imported cases can be reported on an annual basis.
- Malaysia: The malaria programme can submit the requested data by January 2018 with the exception of the number of suspected cases.
- Republic of Korea: Peak malaria transmission season is June to December each year and data are submitted weekly during that period. While KCDC receives data, the public sector must approve the data and the process before the delegation confirms a timeline. The programme will provide the Regional Office its data upon clearance, ideally before the end of 2017.

Overall, the Regional Office is requesting 2015–2016 data as per the World Malaria Report but also disaggregated monthly from subnational levels. If all data are not available, the Regional Office will look to set baselines for 2015 with aggregated data to advance monitoring of the Regional Action Framework. The sooner disaggregated monthly data are submitted, the better support the Regional Office can provide to countries.

### 2.8.3 Closing remarks
Dr Jacobs gave the closing remarks. He thanked everyone for coming to Manila to join the meeting on surveillance strengthening, and thanked the national malaria programmes and the Ministries of health for the progress achieved in malaria control efforts. He highlighted again the importance of strengthening surveillance to move further towards elimination.

3. CONCLUSIONS AND RECOMMENDATIONS

*Malaria Surveillance, Monitoring and Evaluation: An Operational Manual* was presented, emphasizing the importance of malaria surveillance as a core intervention. Subsequent discussions focused on clarifying terminology and definitions of surveillance for elimination, clearly identifying populations at risk, confirmed cases, reporting completeness, and case and foci investigation and classification. The regional indicators were presented and discussed in detail and the regional DHIS2 platform was demonstrated. Each country commented on the feasibility and challenges to submit monthly subnational data disaggregated by age and gender and consensus was reached for indicators. Countries agreed to submit data before the end of 2017, with a few exceptions.

The DHIS2 was well-received by countries as an effective surveillance tool. Participants accessed and analysed their data on the regional database. It was agreed that country focal points would be able to access their specific dashboards on the regional web-based platform.

National updates from burden reduction and elimination countries provided insights into challenges and opportunities with existing surveillance platforms: from China’s 1-3-7 strategy to Malaysia’s foci mapping capabilities and Cambodia’s DHIS2 Tracker pilot. Work remains to update existing platforms to be elimination ready. Data collection and analysis tools for achieving elimination were demonstrated and discussed. The DHIS2 technical group from the University of Oslo and Population Services International demonstrated currently available web-based tools for real-time reporting and tracking for case and foci investigation, classification and follow up.

The *World Malaria Report 2017* data submission progress was presented by the Global Malaria Programme, and data discrepancies were discussed. The national programmes agreed to finalize their submissions, via the regional approval process, before the 30 June deadline.

3.1 Recommendations for Member States

Member States are encouraged to do the following:

1. Develop national malaria surveillance guidelines and standard operating procedures based on WHO regional and global surveillance and elimination manuals and frameworks and in the context of national capacity.
2. Update national malaria surveillance tools, procedures, people and structures to transition towards elimination-capable surveillance, and as detailed in national surveillance guidelines and standard operating procedures.
3. Burden reduction countries are urged to start improving surveillance from the lowest administration levels, focusing on reporting completeness and data quality with accurate parasitological diagnosis. Once established and fully functional the system may be improved in a step-by-step manner by integrating elimination requirements as capacity allows and disease burden reduces. Eliminating countries are recommended to use strengthened surveillance systems for better case and foci identification, investigation, classification and follow-up with active case detection, and monitoring environmental vulnerability and receptivity.
4. Submit data to WHO, as agreed, and where possible before the end of 2017, as possible, including monthly subnational (district or equivalent) disaggregated by age (<5, 5–14, 15+) and gender (where available) for 2015–2016, and use the new indicators for surveillance from 2018.
3.2 Recommendations for WHO

WHO is requested to do the following:

- Consider malaria surveillance enhancement as integrated systems strengthening: that is, as national and regional malaria DHIS2 platforms improve though surveillance strengthening, additional disease surveillance efforts can be included, as with the regional DHIS2 platform housed with the WHO Regional Office for the Western Pacific Health Intelligence and Innovation unit.
- Mobilize resources to continue the provision of country technical and financial support in implementing surveillance strengthening activities, such as technical assistance during the development of national surveillance manuals and standard operating procedures.
- Continue regional activities to support countries in strengthening their malaria surveillance, including supporting data submission for the regional surveillance database and the World Malaria Reports, and facilitating external quality assessment of data quality and completeness.
- Support and facilitate regional and global, monthly and annual data submissions by the national malaria programmes.
## Core data elements for surveillance in the Western Pacific Region

### i) Burden reduction and elimination

<table>
<thead>
<tr>
<th>Data elements</th>
<th>Disaggregation</th>
<th>Frequency</th>
<th>Lowest level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of inpatient malaria cases</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria deaths</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria cases tested with microscopy</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of cases positive with microscopy</td>
<td>&lt;5, 5-14, 15+, M/F</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of Plasmodium falciparum (microscopy)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of Plasmodium vivax (microscopy)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of Plasmodium knowlesi (microscopy)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of Plasmodium ovale (microscopy)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of mixed/malaria species (microscopy)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria cases tested with RDT</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of cases positive with RDT</td>
<td>&lt;5, 5-14, 15+, M/F</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of Plasmodium falciparum (RDT)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
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<tr>
<td>Number of Plasmodium vivax (RDT)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of mixed/malaria species (RDT)</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of long lasting insecticide treated nets distributed</td>
<td>Total</td>
<td>Annually</td>
<td>District or equiv (Admin 2)</td>
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<tr>
<td>Number of people protected by IRS</td>
<td>Total</td>
<td>Annually</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of cases treated</td>
<td>Total</td>
<td>Annually</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Population (total)</td>
<td>Total</td>
<td>Annually</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Population at risk (or in foci)</td>
<td>Total</td>
<td>Annually</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of health facilities expected to report</td>
<td>Total</td>
<td>Annually</td>
<td>District or equiv (Admin 2)</td>
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<tr>
<td>Number of health facilities reporting</td>
<td>Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
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</tbody>
</table>

### ii) Elimination

<table>
<thead>
<tr>
<th>Data elements</th>
<th>Disaggregation</th>
<th>Frequency</th>
<th>Lowest level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of malaria cases investigated</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria cases classified</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria cases classified as local</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria cases classified as imported</td>
<td>&lt;5, 5-14, 15+, Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria cases investigated within 4 days of diagnosis</td>
<td>Total</td>
<td>Monthly</td>
<td>District or equiv (Admin 2)</td>
</tr>
<tr>
<td>Number of malaria foci identified (name, long/lat)</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of malaria foci identified (as new)</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of malaria foci investigated</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of malaria foci investigated within 6 days of diagnosis</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of malaria foci classified</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of malaria foci classified as active</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of malaria foci classified as residual non-active or cleared</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of malaria foci with response</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
<tr>
<td>Number of foci with response within 10 days of diagnosis</td>
<td>Total</td>
<td>Monthly</td>
<td>Foci or above</td>
</tr>
</tbody>
</table>
## Day 1: Wednesday, 21 June 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker/Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30 – 09:00</td>
<td>Registration</td>
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<tr>
<td>09:00 – 09:30</td>
<td><strong>Opening Session</strong></td>
<td>Regional Director, WPRO</td>
</tr>
<tr>
<td></td>
<td>Welcome remarks</td>
<td>Dr Shin Young-soo</td>
</tr>
<tr>
<td></td>
<td>Meeting objectives</td>
<td>Dr Rabindra Abeyasinghe</td>
</tr>
<tr>
<td></td>
<td>Self-introduction of participants and observers</td>
<td>Coordinator WPRO/MVP</td>
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<tr>
<td></td>
<td>Nomination of the Chair and Rapporteur</td>
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<tr>
<td></td>
<td>Administrative announcements</td>
<td>Dr James Kelley, Consultant, WPRO/MVP</td>
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<tr>
<td>09:30 – 10:00</td>
<td>Group photograph followed by coffee/tea break</td>
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<tr>
<td>10:00 – 10:30</td>
<td><strong>Session 1: Global and regional updates</strong></td>
<td>Dr Abdisalan Noor, Team Leader, SUR, HQ/GMP</td>
</tr>
<tr>
<td></td>
<td>Malaria surveillance, monitoring and evaluation – An operational manual</td>
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<tr>
<td>10:30 – 10:50</td>
<td>Regional action framework for malaria control and elimination in the Western Pacific, 2016-2020 – Strengthening surveillance</td>
<td>Dr Rabindra Abeyasinghe</td>
</tr>
<tr>
<td>10:50 – 11:10</td>
<td>Discussion</td>
<td>Moderator: Chair</td>
</tr>
<tr>
<td>11:10 – 11:30</td>
<td>Proposed malaria surveillance indicators for the Western Pacific region</td>
<td>Dr James Kelley</td>
</tr>
<tr>
<td>11:30 – 11:50</td>
<td>An interactive view of the malaria surveillance platform and data collection tools for the Western Pacific region</td>
<td>Mr Joven Larin</td>
</tr>
<tr>
<td>11:50 – 12:30</td>
<td>Discussion</td>
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<tr>
<td>12:30 – 13:30</td>
<td>Lunch break</td>
<td></td>
</tr>
<tr>
<td>13:30 – 14:00</td>
<td><strong>Session 2: Surveillance in burden reduction countries: updates and discussion</strong></td>
<td>Lao People’s Democratic Republic</td>
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<tr>
<td></td>
<td>Malaria surveillance in the Lao People’s Democratic Republic using the district health information system version 2 (DHIS2)</td>
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<tr>
<td>14:00 – 14:30</td>
<td>Malaria surveillance in PNG – challenges, lessons learnt and a way forward</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td></td>
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<tr>
<td>14:30 – 15:00</td>
<td>Experience increasing health facility reporting rates in Solomon Islands using DHIS2</td>
<td>Solomon Islands</td>
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<tr>
<td></td>
<td>Discussion</td>
<td></td>
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<tr>
<td>15:00 – 15:20</td>
<td>Coffee / tea break</td>
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</tr>
<tr>
<td>15:20 – 15:50</td>
<td><strong>Session 3: Surveillance in countries transitioning towards elimination: updates and discussion</strong></td>
<td>Cambodia</td>
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<tr>
<td></td>
<td>Experience using DHIS2 Tracker for malaria case-based reporting and case investigation in Battambang</td>
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<tr>
<td>15:50 – 16:20</td>
<td>Malaria surveillance in the context of a phased elimination approach</td>
<td>Philippines</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
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<tr>
<td>16:20 – 16:50</td>
<td>Experience initiating DHIS2 for malaria surveillance in Vanuatu – burden reduction and elimination</td>
<td>Vanuatu</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
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<tr>
<td>16:50 – 17:20</td>
<td>Malaria surveillance in Viet Nam including insecticide resistance monitoring</td>
<td>Viet Nam</td>
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<tr>
<td></td>
<td>Discussion</td>
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<tr>
<td>17:20 – 19:00</td>
<td>Reception</td>
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</table>
## Session 4: Surveillance on the pathway to elimination: technical discussions

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00 – 09:20</td>
<td>A framework for malaria elimination</td>
<td>Dr Abdisalan Noor</td>
</tr>
<tr>
<td>09:20 – 09:40</td>
<td>Case classification and foci classification</td>
<td>Dr Rabindra Abeyasinghe</td>
</tr>
<tr>
<td>09:40 – 10:00</td>
<td>Discussion</td>
<td>Moderator: Chair</td>
</tr>
<tr>
<td>10:00 – 10:20</td>
<td>Coffee/tea break</td>
<td></td>
</tr>
<tr>
<td>10:20 – 10:50</td>
<td>2017 World Malaria Report – DHIS2, data collection tools and update on data entry progress</td>
<td>Mr Ryan Williams, Technical Officer, SUR, HQ/GMP</td>
</tr>
<tr>
<td>10:50 – 11:20</td>
<td>DHIS2 for malaria surveillance in burden reduction and elimination settings: strengths and weaknesses of the online, open-source platform</td>
<td>Dr Hong Anh Chu, Technical Officer, Health Information Officer, WPRO/Lao People’s Democratic Republic</td>
</tr>
<tr>
<td>11:20 – 11:50</td>
<td>Improving private sector malaria case surveillance and quality assurance using DHIS2: lessons learnt</td>
<td>Ms Lorina McAdam, Greater Mekong Subregion Malaria Elimination Program, PSI</td>
</tr>
<tr>
<td>11:50 – 12:20</td>
<td>Discussion</td>
<td>Moderator: Chair</td>
</tr>
<tr>
<td>12:20 – 13:20</td>
<td>Lunch break</td>
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</table>

## Session 5: Surveillance in countries targeting elimination by 2020: updates and discussion

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:20 – 13:50</td>
<td>Malaria surveillance in an elimination setting: China’s 1-3-7 Strategy and the importance of timely response</td>
<td>Professor Gao QJ, Temporary Advisor</td>
</tr>
<tr>
<td>13:50 – 14:20</td>
<td>Experience with malaria case investigation and response</td>
<td>Malaysia</td>
</tr>
<tr>
<td>14:20 – 14:50</td>
<td>Experience with malaria case investigation and response</td>
<td>China</td>
</tr>
<tr>
<td>14:50 – 15:20</td>
<td>Response to vivax malaria cases</td>
<td>Republic of Korea</td>
</tr>
<tr>
<td>15:20 – 15:40</td>
<td>Coffee/tea break</td>
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</tbody>
</table>

## Session 6: WHO global and regional malaria surveillance databases

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:40 – 16:30</td>
<td>DHIS2 Data Tracker for malaria surveillance in an elimination setting (video link)</td>
<td>Professor Jørn Braa, Research Group for Information Systems, University of Oslo</td>
</tr>
<tr>
<td>16:30 – 17:00</td>
<td>Health intelligence in the Western Pacific: the importance of organizational units and shape files to improve integration using DHIS2</td>
<td>Dr Jun Gao, Coordinator, WPRO/HII</td>
</tr>
<tr>
<td>17:00 – 17:30</td>
<td>Discussion</td>
<td>Moderator: Chair</td>
</tr>
<tr>
<td>17:30 – 18:00</td>
<td>Coffee/tea break</td>
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## Day 3: Friday, 23 June 2017

### Session 7: Technical discussion: definitions and components of malaria surveillance

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>09:00 – 09:30</td>
<td>Definitions of malaria surveillance indicators</td>
<td>Dr Abdisalan Noor, Dr Rabindra Abeyasinghe</td>
</tr>
<tr>
<td>09:30 – 09:50</td>
<td>Surveillance for the prevention of malaria reintroduction</td>
<td>Dr Rabindra Abeyasinghe</td>
</tr>
<tr>
<td>09:50 – 10:15</td>
<td>Discussion</td>
<td>Moderator: Chair</td>
</tr>
<tr>
<td>10:15 – 10:30</td>
<td>Coffee/tea break</td>
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<td>10:30 – 11:00</td>
<td>Monitoring drug and insecticide resistance in the Western Pacific</td>
<td>Dr Rabindra Abeyasinghe</td>
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<td>11:00 – 11:30</td>
<td>WHO malaria surveillance databases – World Malaria Report and Western Pacific Region platforms</td>
<td>Mr Ryan Williams, Dr James Kelley</td>
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<tr>
<td>11:30 – 12:00</td>
<td>Discussion</td>
<td>Moderator: Chair</td>
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<td>12:00 – 13:00</td>
<td>Lunch break</td>
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### Session 8: Consensus building for regional and national elimination-ready surveillance platforms

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<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
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<tr>
<td>13:00 – 13:20</td>
<td>Consensus building for regional indicators and data submission</td>
<td>Dr James Kelley</td>
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<tr>
<td>13:20 – 14:30</td>
<td>Regional milestones and timelines for strengthening surveillance</td>
<td>Moderator: Chair</td>
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<td>14:30 – 14:50</td>
<td>Coffee/tea break</td>
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<tr>
<td>Time</td>
<td>Session</td>
<td>Description</td>
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<td>14:50 – 15:50</td>
<td>Development of national timeline to deploy an</td>
<td>elimination ready platform</td>
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<td>15:50 – 16:50</td>
<td>Interactive session – national data entry into</td>
<td>regional DHIS2 data platform</td>
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<td>16:50 – 17:10</td>
<td>Conclusions and closing</td>
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<td>17:10 – 17:30</td>
<td>Closing</td>
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ANNEX 3

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