World Health Organization
Western Pacific Region

WESTERN PACIFIC REGIONAL ACTION PLAN for

Dengue Prevention and Control (2016)

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CONTENTS

ABBREVIATIONS

APSED	Asia Pacific Strategy for Emerging Diseases
EBS	event-based surveillance
IADTF	Inter-Agency Dengue Task Force
IBS	indicator-based surveillance
IVM	integrated vector management
KPI	key performance indicator
M&E	monitoring and evaluation
RAP	Regional Action Plan
VCAG	Vector Control Advisory Group (WHO)

FOREWORD

The global incidence of dengue has grown dramatically in recent decades. In the Western Pacific Region, the number of reported dengue cases has more than doubled from about 200 000 in 2008 to over 450 000 in 2015. Prompted by concern over the increasing dengue incidence in the Region and the presence of other arboviral infections, Member States requested a new regional action plan for dengue at the sixty-fifth session of the WHO Regional Committee in 2014, in light of the impending end of the *Dengue Strategic Plan for the Asia Pacific Region 2008–2015*.

The *Dengue Strategic Plan for the Asia Pacific Region 2008–2015* guided Member States in strengthening national capacities for surveillance, clinical management, early detection, preparedness and response to outbreaks and vector control. Although the reported incidence of dengue doubled during that time, partly due to strengthened diagnostic capacities, the regional case fatality rate was halved from 2008 to 2014. These trends indicate that while the Region has been largely unsuccessful in containing dengue, it has nonetheless made progress in dengue detection, assessment and management.

The WHO Regional Office for the Western Pacific facilitated the development of the *Western Pacific Regional Action Plan for Dengue Prevention and Control (2016)* in consultation with dengue experts, country programme managers and Member States.

The goal of the *Western Pacific Regional Action Plan for Dengue Prevention and Control (2016)* is to reduce the health impact of dengue by further reducing case fatality rates and strengthening evidence for action on dengue. The plan recommends a switch in strategy from outbreak containment to reducing the impact of dengue on communities. The recent emergence of Zika virus disease and chikungunya in the Region further supports the need to strengthen the response to dengue and other diseases transmitted by *Aedes* mosquitoes. The plan recommends proactive and sustainable implementation of *Aedes* mosquito-control measures in collaboration with sectors beyond the health sector, and the early implementation of new technologies.

Based largely on the *Global Strategy for Dengue Prevention and Control, 2012–2020,* the regional action plan embraces six enabling factors and five technical elements to strengthen diagnostics and case management, surveillance, risk assessment and outbreak preparedness, implement sustainable vector management, increase attention to community engagement and risk communication and consolidate implementation research and early adoption of emerging technologies.

By working together with ministries of health, national control programmes, research and donor organizations, and other stakeholders, we are hopeful that significant progress can be made to reduce the health impact of dengue in the Western Pacific Region.

Shin Young-soo, MD, Ph.D.
Regional Director

EXECUTIVE SUMMARY

WHO estimated the number of dengue cases globally to be approximately 100 million in 2012. More recent estimates suggest an almost fourfold increase to nearly 390 million annual infections. Dengue is estimated to cause approximately 20 000 deaths a year globally. In the Western Pacific Region, dengue is an endemic disease with epidemic cycles that are associated with social determinants such as rapid urbanization, limited access to basic services, the rapid movement of people and goods, and possibly climate change.

In 2008, the Regional Committee for the Western Pacific endorsed the *Dengue Strategic Plan for the Asia Pacific Region 2008–2015* (resolution WPR/RC59.R6), which has served as a road map for dengue prevention and control efforts in the Region. These efforts have been directed towards strengthening national capacities for surveillance, clinical management, early detection, preparedness, outbreak and vector control. The Region has seen significant progress in strengthening regional and country capacities to detect, assess, report and respond to dengue. However, an incomplete understanding of the disease as well as limited tools and resources have contributed to the Region not witnessing the degree of success expected at the time of endorsement of the Dengue Strategic Plan.

The annually reported number of dengue cases in the Region has grown from approximately 213 000 cases in 2008 to over 460 000 cases in 2014. However, and importantly, improved case management led to a 50% reduction of regional case fatality rates from 0.32% in 2008 to 0.16% in 2014.

Considering the current regional trends in dengue morbidity and mortality, and the current range of available tools, this *Western Pacific Regional Action Plan for Dengue Prevention and Control (2016)* recommends adjusting the approach to dengue, moving the major focus from attempting to contain outbreaks to one of reducing the impact of the disease on communities. The recent emergence of Zika virus disease and chikungunya in the Region, also transmitted by *Aedes* mosquitoes, necessitates a proactive approach to reducing the breeding of *Aedes* mosquitoes. Thus greater efforts are required to strengthen the response to dengue and these other diseases, and this will require increased collaboration and coordination within and beyond the health sector.

The Regional Action Plan is modelled on the *Global Strategy for Dengue Prevention and Control 2012–2020* and includes six enabling factors and five technical elements. It aims at building on the success achieved in reducing case fatality rates in the Region to minimize the health impact of dengue on communities and on health services. Actions proposed in the Plan include strengthening diagnostics and case management, surveillance, risk assessments and outbreak preparedness; implementing sustainable vector management; increasing attention to promoting community engagement and risk communication; strengthening implementation research and promoting early adoption of emerging technologies.

1. Introduction

1.1 Background

Dengue continues to cause severe health, social and economic impacts worldwide. The recent emergence of hyper-endemic dengue and the co-circulation of more than one serotype of dengue in many countries of the Western Pacific Region, together with other factors, may be responsible for an increasing number of severe forms of the disease. Over the last 50 years, there has been a 30-fold increase in the reported number of dengue cases globally. Recognizing this challenge, the WHO Regional Committee for the Western Pacific, at its fifty-ninth session in 2008, endorsed the *Dengue Strategic Plan for the Asia Pacific Region 2008–2015* (resolution WPR/RC59.R6), which served as a road map for dengue prevention and control efforts in the Region. These efforts have been directed towards strengthening national capacities for surveillance, clinical management, early detection, preparedness, outbreak and vector control.

Although significant progress has been made in strengthening regional and country capacities to detect, assess, report and respond to dengue, the Region has not seen the degree of success expected from the *Dengue Strategic Plan for the Asia Pacific Region 2008–2015*. Efforts to tackle dengue have been constrained by a lack of new and effective tools, which were expected to become available during the period covered by this strategic plan. An incomplete understanding of the disease and limited tools and resources have made it difficult to sustain efforts to control dengue, and its burden continues to increase. However, improved case management in the Region has contributed to a 50% reduction in case fatality rates, from 0.32% in 2008 to 0.16% in 2014. The early adoption of new tools as they are validated, investing and undertaking research related to the development of new tools and making better use of available interventions will contribute to mitigating the challenge of dengue.

1.2 Scope

Although there has been progress in many areas of prevention and control under the *Dengue Strategic Plan for the Asia Pacific Region 2008–2015*, the burden of dengue in the Region continues to increase. Another challenge is the emergence of other arboviral diseases in the Region such as Zika virus disease and chikungunya, which share similar risk factors.

In response, the *Western Pacific Regional Action Plan for Dengue Prevention and Control (2016)* provides a framework of actions to enhance country- and regional-level progress towards reducing morbidity and mortality from dengue and other arboviral diseases. This new regional action plan (RAP) seeks to maximize and enhance resources across the Region to deliver sustainable, effective, evidence-informed prevention and control efforts against dengue and other arboviral diseases, such as Zika virus disease and chikungunya.

1.3 Intended target

The RAP is directed at ministries of health, national control programmes, subnational programmes, research and funding organizations, and other stakeholders such as environmental agencies, urban planners, water resource suppliers, educators and managers involved in dengue prevention and control (also Zika virus disease and chikungunya).

1.4 Approach

- The RAP provides a common framework for countries, WHO and other stakeholders to work together to enhance regional prevention and control of dengue and other arboviral diseases.
- The RAP is a "living document" that will include guidance on novel tools and advances in arboviral disease management as they become available.
- Donors, development agencies and other partners are encouraged to use the RAP to prioritize country support for arboviral prevention and control efforts by maximizing the use of available resources, especially national resources.
- The RAP is broadly aligned with the *Global Strategy for Dengue Prevention and Control 2012–2020,* with Region-specific priorities, considerations and terminology. It also reflects, harmonizes and links, where relevant, the *Asia Pacific Strategy for Emerging*

Diseases (APSED), particularly the development of core capacities under the International Health Regulations (2005).

- Prevention and control measures outlined in the RAP for dengue and other arboviral diseases are expected to contribute to the achievement of multiple targets of the United Nations Sustainable Development Goals (SDGs).

1.5 Guiding principles

The following principles have been considered in developing the RAP and will be used to guide implementation.

- Country ownership of prevention and control efforts is the primary focus. Policies should not be limited to the health sector, and activities should be supported by partnerships and intersectoral approaches.
- Policies and activities implemented under the RAP should always be evidence-based, taking into consideration equity, gender ethics and locally available knowledge and expertise.
- Collective action within and between countries should be harmonized and strengthened, including the timely sharing of information to reduce the impact of the disease within countries and the Region.
- Countries are encouraged to adopt novel tools when validated for operational use.
- Success is achievable, irrespective of a country's epidemiology, current capacities and resources. For the purpose of monitoring the progress achieved through implementation of this RAP the baseline will be considered as 2015.
- Integrated community-based approaches, including addressing environment cleanliness, viruses, vector control, population mobility and climate change need to be emphasized.

Overview of the Western Pacific Regional Action Plan for Dengue Prevention and Control (2016)

GOAL	**Reduce the health impact of dengue**
OBJECTIVES	**Reduce fatalities due to dengue**
	Strengthen evidence for action on dengue
ENABLING FACTORS	
	1. Skills, processes and resources
	2. Monitoring, review and corrective action
	3. Risk communication
	4. Partnership, coordination and collaboration
	5. Advocacy and resource mobilization
	6. Research
TECHNICAL ELEMENTS	
	1. Laboratory diagnostics and case management
	2. Surveillance, risk assessment and outbreak preparedness
	3. Sustainable vector management
	4. Implementation research
	5. Evaluation of emerging technologies

2. Goal and objectives

2.1 Goal

To reduce the health impact of dengue.

2.2 Objectives

2.2.1 Reduce fatalities due to dengue

Prioritizing the reduction of dengue mortality will focus investment on encouraging infected individuals to seek early treatment and improving diagnosis and management of dengue cases at all levels of health-care delivery. Morbidity will also be impacted by concentrating efforts on mortality reduction. In areas where mortality from dengue is not a concern, emphasis on morbidity reduction should be strengthened.

Surveillance systems are being developed and enhanced across the Western Pacific Region; however, reliable dengue data are not currently available in all countries. Therefore, each country should determine relevant targets and time frames for reduction of dengue mortality and morbidity based on their epidemiology, surveillance system and context.

2.2.2 Strengthen evidence for action on dengue

It is important for the Region to learn and adopt successful examples for effective dengue control and to closely review the early adoption of new interventions as and when they are approved for public health programmes. While there are a large number of such examples globally, there are also several examples within the region. A careful analysis and adoption of such interventions in Member States will contribute to reducing the health impact of dengue. Estimating the true health impact of dengue by defining the disease epidemiology in countries is also important for better targeting of interventions to reduce mortality from a spatio-temporal perspective. Using this information and

early implementation of new interventions such as vaccines and new vector control interventions will help reduce the health impact of dengue in the Region. The health impact of dengue includes mainly mortality, but may also be linked to morbidity and also be affected by the social and economic impacts of the disease.

Formal surveillance and disease reporting mechanisms may not provide true morbidity and mortality data for the Region in the short term. Awareness of seroprevalence is also now essential for countries considering introduction of dengue vaccines.

3. Enabling factors

To implement the RAP at country level, six enabling factors are necessary across government sectors and at all health system levels:

1. Skills, processes and resources

2. Monitoring, review and corrective action

3. Risk communication

4. Partnership, coordination and collaboration

5. Advocacy and resource mobilization

6. Research

ENABLING FACTOR 1

Skills, processes and resources

Human and other resources capacity must exist to effectively implement evidence-based dengue prevention and control programmes. Development of skills, processes and resources is required across the Region in the areas of case identification, case management, diagnostics, surveillance, vector control, risk communication, surge and outbreak management, and evaluation.

Countries need to identify capacity gaps and requirements for addressing them. Dengue should also be used as a pathfinder to build overall health system capacity and health security readiness through improving planning, procurement, implementation and management and evaluation of prevention and control programmes.

Human resources capacity can be developed through novel and sustainable training and mentoring mechanisms. These should maximize regional expertise, such as:

- WHO fellowships and twinning of health-care facilities to share diagnostic and management experience within the Region.
- Laboratory and vector control mentoring programmes to build technical independence and in-country capacity.
- Biennial Asia Pacific dengue training and international training programmes on integrated vector management, including work streams in diagnostics, laboratory, clinical management, vector control, risk communication, and surge and outbreak management. Training should always be evaluated to ensure it is serving the intended purpose. Training of trainers is needed to ensure sustainability and assess the long-term impact and quality of training. Policy-makers and managers also need to be trained in organizing and conducting outbreak responses. Where possible and appropriate, training should be provided in countries, to ensure multiple in-country staff can be trained simultaneously.
- e-learning and virtual tools on all aspects of dengue prevention and control, which could be developed by WHO or by countries and shared on internet platforms.

Building community capacity is also essential, through mobilizing participants to engage in dengue control programmes.

ENABLING FACTOR 2

Monitoring, review and corrective action

Monitoring and evaluation (M&E) of dengue prevention and control activities needs to be enhanced, with corrective actions made where appropriate. This includes regular review of countries' prevention and control programmes, as well as routine surveillance and outbreak "after-action" reviews. Data should be gathered from established information systems wherever possible.

Countries should undertake regular progress reviews of their dengue prevention and control activities, using a simple template predefined by WHO as a minimum (to be developed by WHO). This includes key performance indicators (KPIs) in health and other sectors on surveillance, vectors, laboratory, clinical management and response. Reviews should identify whether KPIs were met and any corrective actions that have been undertaken or are planned.

National surveillance programmes should regularly report dengue data to WHO, including numbers of suspected cases, deaths in suspected or confirmed cases, age and sex

distribution, laboratory-confirmed cases and serotypes of confirmed cases. Monitoring serotypes will guide potential vaccine implementation and assist with managing surges and risk communication. Monitoring vectors also allows the impact of interventions to be measured and help understand the effectiveness of vector control interventions. Debriefings and reviews of dengue outbreaks are essential to evaluate outbreak preparedness, and inter-outbreak interventions and to determine process improvements. Results should be shared among different sectors and lead to development of corrective action plans.

WHO will routinely collate and report surveillance data, learning from programmes and outbreak reviews to ensure lessons are being shared among countries.

ENABLING FACTOR 3

Risk communication

Risk communication for dengue includes short-term outbreak communications and longer-term strategies for populations in endemic areas.

Effective risk communication involves multiple steps: analysing the problem in a particular area or population (surveillance and risk assessment data); developing and delivering messages to the intended target audience on what needs to change; and evaluating whether the communication was effective in achieving the desired outcome. Where possible, involvement of risk communication expertise in planning and delivering messages is encouraged.

In dengue-endemic areas, community awareness of dengue risk and relevant behavioural change outcomes need to be prioritized. Raising community awareness should include focusing on school children as well as respected members of the community, such as community elders. Behavioural change outcomes could include seeking early medical attention if experiencing dengue-like symptoms and mobilization of the community in source reduction.

Dengue outbreaks often result in significant political and health service pressure. Dengue quickly becomes a high priority for health ministers, as outbreak management that is seen as unsuccessful can hinder public confidence in the health system and government. This becomes particularly problematic when a surge leads to health services becoming overcrowded or there are severe dengue cases or deaths, all of which are likely to be reported in mass and social media. To mitigate this, it may be useful to

adopt a communication strategy that makes it clear what the aims of the efforts to prevent and respond to dengue are, and what role communities and individuals can play, particularly if this strategy is implemented before as well as during outbreaks.

There are some parallels to the approach to, and communication concerning, influenza epidemics and pandemics. Risk communication both in the inter-epidemic period and during outbreaks should focus on the risks posed by dengue and other arboviral diseases, actions people can take to reduce their own risk, and what prevention and response actions are seeking to achieve. As well as working towards strengthening ongoing community action against these diseases, this approach should aim to better inform community and media expectations regarding dengue prevention and control, and better align these expectations with what programmes are seeking to and are able to achieve.

For example, messaging could focus on key aspects such as that future cases and outbreaks of dengue and other arboviruses are expected: responses to outbreaks will have a primary focus on reducing health impacts through reducing mortality from the disease and reducing impacts on health facilities through "flattening the epidemic curve"; when people should seek care and what actions individuals, families and communities can take to reduce their risk.

These messages should always be made relevant to the local context and provide progressive actions that can be taken if needed.

BOX 1. Dengue risk communication

Singapore uses various channels to communicate the dengue transmission risk to the public. Annually, the "Mozzie Wipe Out" campaign is launched throughout the island with mass participation from grass roots leaders and residents.

The dengue website and the MyENV app are updated daily from Monday to Friday with locations where dengue transmission is reported. At these sites, banners are put up to warn residents. Reminders on keeping the environment free of breeding habitats are distributed on community notice boards, and in mainstream and social media.

ENABLING FACTOR 4

Partnership, coordination and collaboration

Effectively preventing and controlling dengue requires partnership, coordination and collaboration at multiple levels: intersectoral; public and private; government and nongovernmental; and national and international. Dengue prevention and control programmes across the Region would benefit from sharing data and experience, coordinating activities and collaborating on research agendas.

At the local level, vector control programmes should be coordinated across government sectors and involve nongovernmental agencies where possible. Ways of achieving this include integrating with urban health programmes, becoming a focus of legislation and regulation in other sectors (such as regulation on garbage collection and building site maintenance), or engaging the tourism industry in clean-up and other vector control methods.

Collaboration of operational and research communities within and between countries has the potential to improve identification of priority research areas, and reduce the gap between research findings and how they are put into practice.

Partnerships and networking are essential to share expertise, experiences and technical issues of the regional interest. For example, networking between laboratories for improving processes, between clinicians to improve patient management and between vector control experts to share cost-effective intervention delivery information. International collaboration on surveillance and data sharing, evaluation of vector control tools and laboratory services are essential as countries in the Region share borders and travellers and have varying levels of resources.

ENABLING FACTOR 5

Advocacy and resource mobilization

Dengue continues to have variable priority across the Region due to limited health funding resources, competing health issues and interventions for control appearing ineffective, as they are implemented too late or without the required rigor. To enable this RAP to have sustained impact and be effective, there is a need to gain political

commitment and mobilize human and financial resources. The plan itself could also be used as an advocacy and resources mobilization tool. Sharing information on the regional dengue burden could raise the profile of the disease and improve its political importance. Following recent outbreaks of Zika virus disease, dengue and chikungunya, there is now more attention on the control of arboviral diseases, and it has become imperative that countries strengthen and launch integrated control programmes for the control of all *Aedes*-borne diseases.

Resorting to emergency funding and responses to outbreaks is not a cost-effective use of resources. To make financing of dengue prevention and control programmes more effective and sustainable, governments should consider how they allocate internal funding. As many programmes work collaboratively with the environmental sector, countries could consider sharing funds across agencies. Consideration of financing mechanisms for addressing vector control for all *Aedes*-borne diseases would also be an efficient use of resources.

Consideration should also be given to developing innovative financing strategies and partnerships in the context of resource-constrained environments. This will require gaining buy-in and agreement on the *Aedes*-borne disease prevention and control agenda with key development partners, for example, the Asian Development Bank. Where able, countries could also consider sharing resources (financial and in-kind) within the Region.

The role of the private sector should also be explored due to the impact dengue has on attendance at work and school, as well as on tourism. Private companies could become involved in dengue prevention and control.

Communities are valuable resources. Attention should be paid to the mobilization of communities towards preventive action to ensure activities are sustainable.

ENABLING FACTOR 6

Research

Research is essential to orient activities for dengue prevention and control, particularly the development of innovative strategies and evaluation of emerging technologies. Research institutions, academics and dengue programme managers should coordinate in developing research agendas.

Partnership, coordination and collaboration are strongly linked with research. An environment of research collaboration should be fostered domestically between institutions and agencies, and between countries within the Region and beyond.

Networking, identifying and partnering with agencies willing to contribute international funding for basic research are essential. Communicating this information with relevant research institutions and developing international collaborations could provide the most useful research outcomes.

BOX 2. General areas for further research in dengue prevention and control

- Seroprevalence studies to estimate the burden of dengue, including the use of available surveillance data.
- Impact of fee-for-service and out-of-pocket-expenditure on dengue health-seeking behaviour.
- Impact of income and poverty on health-seeking behaviour.
- Admission criteria (some countries continue to use platelet count).
- Cultural factors that may play a role in health-seeking behaviour.
- Development and expansion of domestic products that households can purchase or obtain in convenient locations, such as supermarkets, and operate themselves.
- Promote implementation research for domestic-use products so lessons can be shared among countries.
- Health economics of dengue, for example, cost per dengue case or death from dengue in different contexts.
- Effective dengue risk communication.
- Generate evidence necessary for the pilot deployment of sterile insect technique, vector traps and attractive toxic sugar baits.

4. Technical elements

Regional and country focus on five technical elements is needed to achieve the goal of reducing the health impact of dengue:

1. **Laboratory diagnostics and case management**
2. **Surveillance, risk assessment and outbreak preparedness**
3. **Sustainable vector management**
4. **Implementation research**
5. **Evaluation of emerging technologies**

TECHNICAL ELEMENT 1

Laboratory diagnostics and case management

Improving timely and accurate diagnosis of dengue and effective clinical management of dengue cases at all levels of health service delivery are important factors in reducing dengue mortality. Case detection, diagnosis and management are key factors in reducing dengue mortality and morbidity and can be facilitated by:

- encouraging early treatment-seeking behaviour;
- early recognition of the disease;
- appropriate fluid replacement for children and adults;
- guidelines for case management and referral based on clinical judgement and local context;
- improved laboratory diagnostic capacity and quality assurance;
- the ability to conduct full blood counts (including haematocrit); and
- formal systematic mortality reviews.

4.1.1 Laboratories

Laboratories play a key role in disease surveillance, risk assessment and outbreak response. Considerable progress has been made under APSED in strengthening the public health laboratory system by building generic capacities that lay the foundation for dengue testing.

During expert consultations, specific issues were raised: diagnostic testing and quality; laboratory data for surveillance and risk assessment; outbreak preparedness; and the use of new diagnostic technologies.

Diagnostic testing and quality

— Build generic diagnostic capacities for emerging infectious diseases for use in both laboratory and field, including chikungunya virus, Zika virus and other febrile pathogens.

— Ensure confidence in and reliability of data from dengue diagnostics to effectively estimate and manage the dengue disease burden.

— Develop internal quality assurance systems in public and private health facilities at all levels to improve generic diagnostic capacities.

— Participate in global, regional and national external quality assessment programmes to monitor proficiency and target corrective action.

— Develop procurement guidelines to ensure purchase of dengue diagnostic reagents with minimal levels of specificity and sensitivity that can be used in any setting.

Laboratory data for surveillance and risk assessment

— Strengthen systems to link laboratory data with clinical and epidemiological data to inform risk assessment.

— Conduct dengue virus serotyping to monitor disease trends and identify serotype switch.

Laboratory outbreak preparedness

— Ensure sustainable availability of quality-assured dengue diagnostics for resource-constrained contexts, especially during outbreak situations where surge capacity requirements may be increased.

— Develop methods for prioritizing diagnostics, especially during established large outbreaks, while still providing the necessary information to guide public health policy.

Use of new diagnostic technologies

— Identify and introduce new technologies and testing platforms and expand existing reliable technologies to subnational levels of health systems, as appropriate.

— Where possible, introduce dengue virus serotyping to inform epidemiological planning, prevention and control programmes. Introduce genotyping for molecular epidemiology and research purposes.

— WHO collaborating centres provide support for evaluation of new diagnostic technologies, including commercial kits and new multiplex assays.

4.1.2 Case management

Guidelines and referral pathways

Timely and effective management of dengue cases at all levels of health service delivery is essential to reduce mortality from the disease. Guidelines for case management and referral should be based on clinical judgement and local context, rather than diagnostics alone. WHO developed the *Handbook for Clinical Management of Dengue* in 2012 as general guidance.

ACTIONS

- Develop country-specific guidelines on dengue case management based on the *Handbook for Clinical Management of Dengue* (http://www.wpro.who.int/mvp/documents/handbook_for_clinical_management_of dengue.pdf) in conjunction with the local situation and evidence. These should include referral pathways and warning signs for deterioration.
- Document and publish, where possible, details of atypical dengue cases to share key learning.
- Improve access to appropriate health services.
- WHO will develop a standardized care pathway template with relevance to all levels of clinical care, including: recognition of warning signs; recommendations and prompts for specific tests, referral and follow-up; and recognition of point-of-care test utility for clinicians.

Training

Community and hospital-based clinicians require regular training in effective case management, utilizing country-specific guidelines.

ACTIONS

- Regular dengue case management training could be provided for clinicians in all levels of care through the setting up of a national core group of trainers (from community/outpatient to hospital settings, including ICU-level and private sector health-care providers).

- Adapt WHO training materials into national-level materials. These should be updated every 2–3 years. Case management training approaches that could be explored based on country capacities include the following:
  - Classroom teaching of basic core information.
  - Hands-on practical knowledge. Clinicians should be brought to the bedside and exposed to clinical management, such as attending active dengue units for 1–2 weeks and developing dengue mentorship programmes.
  - Training of trainers, to ensure each country or a group of countries has a pool of eligible trainers. This could be modelled on the Advanced Paediatric Life Support Training of Trainers programme.
  - e-learning and virtual training, with videos featuring key elements of case management, including procedures, using platforms such as the Public Health Learning Network in the Pacific.

Mortality review

Dengue has a wide clinical spectrum with mild to severe clinical manifestations. Clinical experience shows it is often difficult to predict which dengue cases will deteriorate and require hospitalization. Formal systematic mortality reviews with established feedback mechanisms will assess events preceding death, and assist in identifying how to improve case management. Although many countries have mortality review processes established, implementation varies across the Region. All countries are encouraged to adopt mortality reviews as a means of understanding causes leading to dengue mortality in their countries, to ensure causes can be appropriately addressed.

ACTIONS

- Develop a WHO template for dengue mortality reviews that is aligned with generic mortality review templates that countries can adapt and use as appropriate to their context. Essential information to gather includes: timeline of case management; disease severity; level of expertise in case management; fluid management; result interpretation; whether the death was avoidable; and lessons learnt.
- Promote external input into local mortality reviews for objectivity.
- Collect information on atypical cases and revise guidance as needed.
- Share key lessons learnt from mortality reviews within and between countries.

TECHNICAL ELEMENT 2

Surveillance, risk assessment and outbreak preparedness

Dengue is a priority disease in the Western Pacific Region. APSED has eight focus areas that can guide preparedness and response activities for dengue. Utilizing existing systems, countries should strengthen surveillance systems that contribute to the use of multiple sources of information for risk assessment. This can guide timely decision-making to effectively control dengue and other arboviral diseases.

These activities need to be undertaken at country and regional levels. Regional preparedness for dengue involves regional surveillance and risk assessment, information-sharing systems, preparedness and response activities. This relies on having established country-level surveillance information that can be shared with the WHO Regional Office in a timely manner.

4.2.1 Surveillance and risk assessment

Country-level surveillance and risk assessment

Multiple sources of information for risk assessment for dengue and other arboviral diseases include: indicator- and event-based surveillance; case-based surveillance; vector surveillance; and virus and environmental data and information. Member States may review the feasibility of each pillar based on their country context to determine what is most appropriate to their needs and capabilities.

Information from the non-health sector data, such as movement of people and goods, would further contribute to risk assessments. Risk assessment should be an ongoing process and systematic, and involve multiple stakeholders and agencies, when appropriate, to guide decision-making for preparedness and response. Forward-planning risk assessments such as utility of risk models and the geographical information system are also encouraged, as they could guide activities to prevent outbreaks or minimize the impact of dengue or other arboviral disease outbreaks.

There are four main pillars of information for dengue risk assessment.

— **Pillar 1: Event- and indicator-based surveillance** – Total number of cases (unconfirmed and laboratory confirmed), severe cases, deaths, clusters of cases, unusual situations, hospitalized cases: data to differentiate locally acquired and imported cases and disaggregated data based on gender, age and location would be ideal. Seroprevalence in selected settings

— **Pillar 2: Virus** – Serotype and genotype in selected settings

— **Pillar 3: Vector** – Mosquito species, insecticide resistance status, key breeding sites and adult population densities

— **Pillar 4: Environmental** – Weather, including temperature, humidity and rainfall

ACTIONS

- Strengthen indicator-based surveillance systems (this may be sentinel sites):
  - focus on a syndromic approach, for example, using "dengue-like illness" to identify potential cases of dengue, and other arboviral diseases;
  - standardize case definitions for dengue and other arboviral diseases;
  - implement a standardized system of reporting throughout all levels of health care;
  - establish clear parameters for reporting across all levels of health care, including the number of suspected cases tested, total number of cases (confirmed and unconfirmed), severe cases, deaths, and hospitalized cases; and
  - review the utility and feasibility of dengue and other arboviral diseases as a notifiable disease, based on the country context.
- Event-based dengue disease surveillance systems should be improved to detect dengue outbreaks as follows:
  - establish and/or strengthen early warning systems to trigger an investigation, detect an outbreak, and swiftly activate a risk assessment and response through health-care workers and laboratories;
  - support mechanisms that facilitate involvement of health-care workers and laboratories in event-based surveillance; and
  - ensure clear procedures for information-sharing through all levels of the health system (district -> province -> national) and links between surveillance and risk assessment, laboratory, and vector control, including a feedback mechanism.
- Review existing systems and other information sources to identify what information sources could be used for risk assessment and what could be used at different phases of an outbreak.
- Initiate multisector policy dialogue to strengthen coordination with other stakeholders for the use of multiple sources of information.
- Utilize existing mechanisms to bring together multiple sources of information, including from indicator- and event-based surveillance for risk assessments.
- Agree on operational arrangements, including delegation of authority, for the risk assessment function within a national centre/unit.

- Conduct systematic risk assessments on an ongoing basis, bringing in different levels of government and stakeholders to contribute where appropriate, using the facilities and resources of an emergency operations centre or similar facility.
- Build a public health workforce for surveillance, risk assessment and response.

Regional surveillance and information sharing

At the regional level, information on dengue is provided through event-based surveillance and indicator-based surveillance and used to conduct risk assessments. As with country-level surveillance and risk assessment, multiple sources of information, including event-based and indicator-based surveillance, as well as social and environmental data, including international movement of people and goods, are required to characterize public health threats and any associated risks at the regional level. Collecting and reporting data at the regional level will improve understanding on which dengue vectors, genotypes and serotypes are circulating.

Regional information sharing, which is an essential part of preparedness and response, involves the timely collection, collation and dissemination of information from a variety of sources to support evidence-based public health action. An information-sharing approach that utilizes innovative technology to enhance knowledge development, exchange and transfer would improve regional information sharing and could contribute to a rapid response to prevent the spread of disease.

In addition, regional rapid response mechanisms may be used to enhance regional emergency response capacity and strengthen its ability to respond to dengue outbreaks regionally, when requested by Member States.

ACTION

- Strengthen regional surveillance, risk assessment and response as follows:
  - link data from different sources and improve data accessibility and quality for risk assessments;
  - explore establishing a web-based real-time system for monitoring trends (within and between countries);
  - develop clear guidelines for information sharing, including genotype, serotype and vector surveillance;
  - conduct and share rapid risk assessments for timely decision-making and action using multiple sources of information, including event-based and indicator- based surveillance and non-health sector information sources;
  - engage, maintain and expand existing technical and operational networks, such as the Global Outbreak Alert and Response Network and WHO Collaborating

Centres, and support functional partnerships or networks when required to strengthen preparedness and rapid response teams; and

- support workforce development through opportunities for Field Epidemiology Training Programme trainees and alumni, for example, through placement within WHO or through deployment for public health emergencies.

4.2.2 Outbreak preparedness

Experience has shown that putting all the right components in place ahead of time provides the foundation for delivering a prompt and effective response when outbreaks occur. One principle of APSED, as agreed by Member States during consultations and lessons learnt from previous public health events, is that investment in preparedness between outbreaks is of utmost importance. It is critical that national plans, structures and resources are in place, and function well, to minimize the public health, social, economic and political impacts of a dengue or other arboviral disease outbreak.

Difficulties arise in outbreaks when emergency and other health services become overwhelmed, severe cases or deaths occur, and increasing political and community pressure is exerted. Flattening the epidemiological curve through effective management of the outbreak "surge" is likely to be achievable in most outbreak situations in the Region, along with focusing on reducing case fatalities.

Response to a dengue or other arboviral outbreak involves multiple sectors, agencies and stakeholders, including private organizations. Strengthening coordination of preparedness and response activities is critical and should be systematized within the health sector and across sectors, including private organizations. It is also essential to ensure there is written authority and clarity of agency roles and responsibilities, through legislation, interagency agreements or other means, to mandate and guide preparedness and response.

Under APSED, it is envisaged that Member States develop and test a generic all-hazards national operational response plan for public health emergencies. This type of plan can be adapted by Member States to become a dengue-specific plan(or other arboviral-specific plan). An ongoing process for reviewing, testing and revising the plan should be in place to improve outbreak preparedness.

Member States can develop a specific dengue plan based on their country context as follows.

- For countries in which dengue is endemic, the overall aim of a preparedness and response plan is to reduce the risk of dengue outbreaks occurring through reducing opportunities for transmission, strengthening and sustaining control measures resulting

in minimizing the clinical, social and economic impacts of the disease. M&E should be planned and implemented to assess the impact of all interventions.

- For countries in which dengue vectors are present without a circulating virus, the preparedness and response plan should focus on strategies to reduce the risk of transmission. These should include the rapid investigation of sporadic cases (clinically suspected or laboratory confirmed) to determine whether they are imported or locally acquired, regular monitoring of vectors and their abundance (particularly in regions with recorded or suspected cases), social mobilization and integrated vector management. Once a locally acquired case is confirmed, the response may be escalated to epidemic response to prevent further spread and/or interruption of transmission.
- For countries in which there is risk of introducing dengue vectors, the preparedness and response plan should focus on entomological surveillance at points of entry (ports, airports, ground crossings) and education of health-care providers and the community about the risk of dengue among travellers, and dengue diagnosis and reporting requirements.

It is also crucial to prepare systems and structures for responding to outbreaks that can be activated immediately and tested regularly. Existing systems and resources can be brought into these response structures when appropriate, and adapted as needed, for example, surveillance systems. Operational readiness is ensuring that all components and resources in the health sector and other sectors are available to allow response plans and structures to be implemented immediately and effectively, including human and financial resources.

ACTIONS

- Utilize existing systematic coordination mechanisms for outbreak preparedness and response within the health sector and across sectors and clarity of agency roles and responsibilities during outbreak preparedness, including intersectoral collaboration to place source reduction on the agenda of other ministries.
- Consider developing a specific dengue and arboviral disease control plan based on the country context using an overarching generic public health emergency plan that can be exercised and evaluated.
- Direct efforts towards improving access to appropriate health services and ensuring that health services have expanded surge capacity, including effective triage systems.
- Align community, health professional and media expectations.
- Ensure response structures have sufficient and appropriate human resources support.

  This includes:

  - mechanisms to obtain expert advice;
  - development of private partnerships, including private laboratories;

    - mechanisms for rapid deployment of extra response personnel;
    - utilizing and training volunteers, community, tertiary institutions and religious groups for vector control; and
    - the use of social media for risk communication.
- Ensure response structures have sufficient and appropriate physical resources, including access to resources for mounting effective vector control.
- Strengthen capacities at points of entry in accordance with International Health Regulations (2005) provisions to minimize the introduction of Aedes mosquitoes.

TECHNICAL ELEMENT 3

Sustainable vector management

A new approach to *Aedes* vector control is needed due to the emergence of Zika virus disease and chikungunya in the Region and as funding and trained human resources continue to be a challenge in many environments. Sustainable vector management includes:

- environmental management to prevent or minimize mosquito propagation;
- strong policy and regulatory frameworks with strategic planning to support vector surveillance and control activities, such as enabling surveillance, approvals for insecticides, habitat mitigation measures and reporting;
- country's ability to continue the programme from year to year, from a capacity and affordability perspective;
- effective programmes with an M&E framework; and
- quality assurance of vector control tools.

Aedes vector surveillance and response should be guided by epidemiological data. Key areas for action in sustainable vector management include a focus on strategically timed source reduction, adult mosquito sampling, larval surveillance to determine key breeding sites, well implemented vector control programmes based on targeting key breeding sites in advance and during transmission seasons, intersectoral linkages, insecticide resistance monitoring and management, and developing novel vector control strategies. Communication for behavioural impact and community engagement are also essential for an integrated vector management approach.

The WHO Vector Control Advisory Group (VCAG) evaluates new technologies and their potential adaptability to different contexts, from an independent perspective. The Advisory Group makes recommendations to WHO on whether there is value in including new technologies for vector control in dengue and other vector-borne disease control programmes. At its emergency meeting in March 2016, the VCAG reiterated that well implemented vector control programmes can contribute to the reduction of *Aedes* mosquito transmitted diseases, such as dengue fever and Zika virus disease. The following were identified as appropriate *Aedes* vector control responses.

- Targeted residual spraying of resting sites of *Aedes* spp. mosquitoes primarily inside and, to a lesser extent, around houses as the primary vector control intervention for immediate response.
- Space spraying is effective inside buildings where *Aedes* spp. mosquitoes rest and bite. It has no residual effect. Its application outdoors only suppresses vector populations temporarily and is not as effective as indoor space spraying.
- Larval control, including source reduction and larviciding, should be applied where appropriate through community mobilization.
- Personal protection measures should be used to protect against day biting mosquitoes. These include the use of appropriate repellents and wearing light-coloured loose-fitting clothing. This is especially important during pregnancy.

4.3.1 Year-round source reduction

Currently available vector control methods cannot be easily scaled up during outbreaks due to technical challenges and resource constraints, resulting in reduced effectiveness of interventions overall. There is a need to enhance source reduction throughout the year, including in the dry season, rather than engaging in reactive vector control after outbreaks begin. This would decrease the opportunity for breeding between epidemics and ideally contribute to reducing the scale and frequency of outbreaks not only of dengue but also other disease transmitted by *Aedes* mosquitoes. Such an approach will require intersectoral action to ensure it is sustained from month to month, and year to year.

ACTIONS

- Encourage intersectoral approaches and community mobilization for year-round source reduction.
- Ensure vector breeding is suppressed in known urban infrastructure that cannot be removed, such as water tanks, rainwater collection tanks, sump pits, down pipes and gutters. These sites contribute to sustaining low-level vector densities even during dry seasons and therefore require attention throughout the year.

- Ensure vector breeding is prevented on construction sites and dump yards through legislation and inspections.
- Focus on sustainable and evidence-informed vector control strategies aimed at reducing vector densities by source reduction throughout the year. This includes reducing breeding sites and potential breeding sites in the inter-epidemic phase. Other factors to consider are:
  - promotion of regular source reduction activities by individuals in their own homes and communities;
  - vector surveillance and response guided by epidemiological data, that is, the most likely areas for an outbreak to initiate or expand;
  - information on historical outbreaks – where they started, intensity of cases and where people believe they were infected, including consideration of possible infection occurring in schools or workplaces;
  - identification of key containers and targeting control efforts towards these;
  - pre-high-risk season campaigns, such as government-sponsored clean-up campaigns;
  - priority on large urban areas where population density is greater, thus creating a more likely source of importations; and
  - vector control methods, especially chemical control methods, which should only be considered if there is adequate capacity to initiate such programmes and ensure sufficient coverage to reduce transmission, considering the area and time available.

4.3.2 Larval management

Larval surveillance is useful to determine key breeding sites and container types, and should therefore be undertaken at least once a year during peak breeding seasons. This information can then be used to target key breeding sites during the transmission season and in preparation for the next year's transmission season.

The extensive regular larval surveillance with calculation of larval indices has not proven to be practical or useful for preventing outbreaks in many settings. Where expertise and resources are available, continuing to collect and analyse these indices could prove useful.

ACTION

- Determining threshold values for larval indices in situations where expertise and resources are available could be useful in policy-making.

4.3.3 Adult mosquito surveillance

Current understanding of dengue ecosystems in communities is limited. Information on adult mosquito populations can significantly benefit dengue prevention and control programmes. A sustained monitoring programme with systematic surveillance of adult mosquitoes using adult traps or ovitraps could inform where breeding sites are, when they are changing, demonstrate the impact of vector control initiatives on biting adults and improve understanding of resistance to insecticides in different communities. As determined by the risk of dengue, mosquitoes could be sent at regular intervals to an agreed facility for identification and testing. Information on key breeding sites and insecticide resistance should also be collected annually and will contribute to risk assessment and outbreak response. Adult sampling can also be used to determine dengue infection rates of *Aedes* in the field, information particularly useful in areas where multiple vectors, such as *Aedes aegypti* and *Aedes albopictus*, are present. Adult mosquito data are also necessary for effective implementation of many novel vector control tools under development, such as Wolbachia and OX513A transgenic mosquitoes. New technologies and partnerships for identifying mosquitoes in areas with limited entomology capacity should be explored.

ACTIONS

- Adult mosquito populations should be monitored to determine the effectiveness of vector control operations and for vector surveillance purposes, with information used to develop vector control plans. Consider the use of NS1-antigen tests to establish which vector is responsible for transmission, if multiple vectors are present, as control programmes could vary depending on which vector is present and their habits, such as living indoors versus outdoors.
- WHO will develop clear guidance for monitoring adult dengue vectors (mosquitoes), using adult sampling tools.
- Determine threshold values for adult indices in situations where expertise and resources are available. This could be useful in policy-making.
- Consider sending vector samples to overseas laboratories for identification or use of digital images to enable entomologists not in the area, including those located internationally, to identify or verify the identification of mosquito species.

4.3.4 Intersectoral linkages

Collaboration with relevant public and private sectors on dengue vector management has sustainable benefits for dengue prevention and control and in reducing the wider impacts of the disease. This could include sectors such as urban planning, water resource management, education, solid waste disposal, environment, production (due to arboviral disease impact on work attendance) and tourism.

ACTIONS

- Develop guidance on intersectoral collaboration for integrated vector management, such as developing urban health and national cleanliness programmes, and using legislative and regulatory measures in other sectors (such as regulation on breeding sites in non-residential properties, for example, garbage collection, keeping premises free from mosquito breeding sites and building site maintenance).
- Build dengue vector control KPIs into other sectors to strengthen and monitor intersectoral collaboration.

BOX 3. Dengue risk communication

Intersectoral collaboration is central to Singapore's efforts in implementing integrated vector management, by establishing partnerships to develop innovative and sustainable initiatives that promote environmental ownership in the community and to prevent the spread of vector-borne diseases. The Inter-Agency Dengue Task Force (IADTF) is one such network that adopts a coordinated approach to dengue prevention and control in Singapore.

IADTF is comprised of public, private and professional organizations, and includes all government bodies that maintain major public infrastructure, have large development works, and attend to common properties in residential areas. IADTF is sensitized to implement and advocate environmental management and mosquito control activities aligned with the national dengue prevention campaign. This task force also provides an excellent platform for parties to resolve cross-agency issues, and to share best practices through enhanced communication and coordination. Combined efforts from various partners mean synergies can help to achieve a multiplier effect in preventing dengue transmission.

4.3.5 Insecticide resistance monitoring and management

Insecticide resistance is a significant concern, with high levels of resistance to pyrethroids already noted in *Aedes* mosquitoes in some countries. A global platform for monitoring insecticide resistance in *Aedes* mosquitoes was initiated in 2016, coordinated by WHO and the Special Programme for Research and Training in Tropical Diseases (TDR).

ACTIONS

- Monitor insecticide resistance for all vector management programmes at least once every two years or more frequently if concerned – for guidelines see the *WHO Global plan for insecticide resistance management in malaria vectors (2012)* and the WHO Pesticide Evaluation Scheme. Information should be shared among the vector control community at national level and with WHO.

- Countries need guidance on how to manage resistance when it is identified, and alternative insecticides for use.
- Strengthen operational training of those engaged in using insecticides and tools, such as the National Operator Certification.
- Encourage development of dengue control programmes that delay resistance emergence or manage resistance effectively.

4.3.6 Novel vector control strategies

Controlling dengue vectors can be complicated by limited access to infected mosquitoes in homes. Domestic use products, such as spatial repellents and surface sprays, should be evaluated and considered for integration into dengue control programmes, or promoted for domestic purchase and use.

ACTIONS

- Carry out carefully planned pilot deployment under operational conditions of two tools (Wolbachia-based biocontrol and OX513A transgenic mosquitoes) accompanied by rigorous independent M&E.
- Develop and expand the use of domestic products that households can purchase or obtain in convenient locations, such as supermarkets, and operate themselves.
- Promote implementation research for domestically used products so that lessons can be shared among countries.

BOX 4. The Malaysian Experience of Dengue Vector Control

The Malaysian Government endeavoured to operationalize most components of the *Dengue Strategic Plan for the Asia Pacific Region 2008–2015*. They aimed to reduce dengue incidence by 10% each year over a five-year period. From 2009 to 2013, this looked promising, however dengue incidence increased three-fold in 2014. Tools, such as fogging, outdoor residual spraying and indoor paint (deltamethrin), were used in attempts to manage the 2014 outbreak. These vector control methods were felt to be ineffective due to difficulties in accessing people's homes and the high-volume, unsustainable resources required to maintain efforts. Malaysia has now moved from specific vector control interventions to a broader focus on a national environmental cleanliness campaign (environmentally friendly open space management) incorporating source reduction to remove *Aedes* breeding sites. This requires multiple government agencies playing different roles to be effective and includes KPIs attached to each agency, so all are engaged in monitoring and have accountability. The campaign aims to address *Aedes*-borne diseases such as dengue, as well as other infectious diseases such as leptospirosis.

TECHNICAL ELEMENT 4

Implementation research

Lack of quality data on dengue is problematic. It hinders both highlighting dengue as a national and regional issue, and evaluating whether interventions are cost-effective. The ability to create, advocate and finance evidence-informed control programmes is therefore restricted. Focusing on implementation research is a regional priority.

ACTIONS

- Train countries on conducting implementation research.
- Countries conduct implementation research to determine what is cost-effective for dengue prevention and control in their own environment (including vector control measures). Every activity in prevention and control programmes should have an implementation plan and be monitored, then evaluated to see whether it is achieving the desired results (see examples, Box 5).
- National programmes should have appropriate capacity in M&E and could be supported through trainings by external experts, including WHO.
- Develop pathways for dissemination of key learning among countries.
- Countries of the Western Pacific Region should contribute to the global platform for monitoring *Aedes* resistance being established by WHO and use findings to inform their prevention and control programmes.

BOX 5. Examples of prevention and control activities for implementation research

- Evaluating effectiveness of vector control programmes targeting larvae and adult populations.
- Evaluating effectiveness of vector control programmes in controlling outbreaks.
- Evaluating different types of adult traps and their usefulness as surveillance tools.
- Evaluating effectiveness of source reduction and environmental management during outbreaks.
- Evaluating effectiveness of social/community mobilization and assessing what needs to be done at the local level, for example, using larvicides in containers where they cannot be removed.

TECHNICAL ELEMENT 5

Evaluation of emerging technologies

4.5.1 Dengue vaccines

A range of dengue vaccine candidates are anticipated to become available in the next few years. Currently there are limited data on the duration of dengue vaccine effectiveness and variability in the interest or ability of Member States to purchase them.

Dengvaxia® was the first to be made available in 2016. The Strategic Advisory Group of Experts (SAGE) on Immunization released recommendations on the use of Dengvaxia® shortly after (http://www.who.int/imunization/sage/en/index.html), and WHO released its position paper on 29 July 2016 (http://www.who.int/wer).

ACTIONS

- Dengue vaccines should not be viewed as a single solution to dengue prevention and control. Vaccine should be implemented in conjunction with other dengue prevention and control measures, such as surveillance and vector control.
- As trials continue and further data on vaccines become available over the next few years, WHO will issue guidance as addenda to the RAP.
- Prior to making decisions on purchasing vaccines, country considerations should include (but not be limited to) number of doses, delivery mechanisms, cost and opportunity cost implications.

4.5.2 Novel vector control tools

Research into new technologies for vector control is ongoing and encouraged. A stronger evidence base of cost-effective, achievable, sustainable and environmentally-friendly vector control interventions will assist countries in deciding what to invest in.

Following its March 2016 meeting, the VCAG recommended the carefully planned pilot deployment under operational conditions of two tools (Wolbachia-based biocontrol and OX513A transgenic mosquitoes) accompanied by rigorous independent M&E. This includes evaluation in terms of efficacy (proven disease impact), cost-effectiveness, sustainability and ability to scale up. The VCAG also concluded that more evidence is required before consideration of the pilot deployment of the three additional tools reviewed (sterile insect technique, vector traps and attractive toxic sugar baits).

ACTIONS

- Consider implementing the March 2016 VCAG recommendations (http://www.who.int/neglected_diseases/news/mosquito_vector_control_response/en/).
- Advice on novel vector control tools will be issued in the former addenda to the RAP as they are recommended for use by VCAG and WHO.
- Work closely with communities where novel vector control tools are being considered to ensure understanding and acceptability of the tool before introduction.
- Empower people to use domestic vector control methods and evaluate their effectiveness.

5. Monitoring progress

Progress towards the *Western Pacific Regional Action Plan for Dengue Prevention and Control (2016)* will be reviewed at the regional level in three years.

Suggested indicators for determining regional progress in dengue control are as follows:

- Number of countries in the Region reporting indigenous dengue transmission.
- Total number of suspected dengue cases, confirmed dengue cases and number of patients tested for dengue.
- Number of deaths attributed to dengue.
- Percentage of countries showing an increase in dengue cases in comparison to the baseline for 2015.
- Percentage of countries showing a decline in dengue mortality (baseline 2015).

Annex 1.

Process of developing the Regional Action Plan

The WHO Regional Committee for the Western Pacific, at its fifty-ninth session in 2008, endorsed the *Dengue Strategic Plan for the Asia Pacific Region 2008–2015* (WPR/RC59.R6), which has served as a road map to prevent and control dengue in the Region. Although there has been progress in many areas, the burden of dengue in the Region continues to increase with nearly 400 000 cases and more than 1000 deaths reported to the WHO Regional Office for the Western Pacific in 2012. Other arboviral diseases are also emerging in the Region, such as chikungunya and Zika virus disease, which share similar risk factors to dengue.

At the sixty-fifth session of the WHO Regional Committee for the Western Pacific, Member States requested that a new regional plan for dengue prevention and control be developed beyond 2015. The Malaria, other Vector-borne and Parasitic Diseases Unit together with the Emerging Disease Surveillance and Response Unit of the WHO Regional Office for the Western Pacific responded to this request and initiated work to develop a new regional action plan for dengue prevention and control (2016).

The agreed first step was an informal consultation with dengue experts covering relevant technical areas, such as surveillance, laboratory, clinical management and vector control. The consultation was to consider complex issues related to dengue prevention and control in the Region and inform a framework for the new regional action plan.

The second step was a wider meeting with additional regional experts and country programme managers to consult on the proposed framework and consider and agree on content. Following this consultation, a first draft of the new Regional Action Plan was composed.

A final meeting with representatives from Member States was held to engage on content and reach agreement and ownership of the plan. The plan was then finalized for consideration of endorsement at the 2016 at the sixty-seventh session of the WHO Regional Committee for the Western Pacific.

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