ASIA PACIFIC MALARIA GUIDE
A QUICK REFERENCE FOR JOURNALISTS AND OTHERS
INTERESTED IN MALARIA AND ITS ELIMINATION IN THE ASIA PACIFIC
<table>
<thead>
<tr>
<th>ACRONYM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>Artemisinin combination therapy</td>
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<td>APLMA</td>
<td>Asia Pacific Leaders Malaria Alliance</td>
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<td>APMEN</td>
<td>Asia Pacific Malaria Elimination Network</td>
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<td>bn</td>
<td>Billion</td>
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<td>CDC</td>
<td>The United States Centre for Disease Control</td>
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<td>DDT</td>
<td>Dichlorodiphenyltrichloroethane</td>
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<td>DOT</td>
<td>Directly observed treatment</td>
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<td>FDA</td>
<td>The United States Food and Drug Administration</td>
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<td>GHG</td>
<td>The Global Health Group</td>
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<td>IPT</td>
<td>Intermittent Preventative Treatment</td>
</tr>
<tr>
<td>IRS</td>
<td>Indoor Residual Spraying</td>
</tr>
<tr>
<td>LLIN</td>
<td>Long-lasting Insecticidal Nets</td>
</tr>
<tr>
<td>MDA</td>
<td>Mass Drug Administration</td>
</tr>
<tr>
<td>MSAT</td>
<td>Mass Screening and Treatment</td>
</tr>
<tr>
<td>QIMR</td>
<td>QIMR Berghofer Medical Research Institute</td>
</tr>
<tr>
<td>RBM</td>
<td>Roll Back Malaria</td>
</tr>
<tr>
<td>RDT</td>
<td>Rapid Diagnostic Test</td>
</tr>
<tr>
<td>SPR</td>
<td>Slide Positivity Rate</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronyms and abbreviations</td>
<td>2</td>
</tr>
<tr>
<td>Contents</td>
<td>3</td>
</tr>
<tr>
<td>Quick facts from the World Malaria Report 2014</td>
<td>4</td>
</tr>
<tr>
<td>Introduction</td>
<td>5</td>
</tr>
<tr>
<td>What is malaria?</td>
<td>6</td>
</tr>
<tr>
<td>How is malaria treated?</td>
<td>7</td>
</tr>
<tr>
<td><em>Drug resistance</em></td>
<td>7</td>
</tr>
<tr>
<td>Where is malaria found?</td>
<td>8</td>
</tr>
<tr>
<td>How can malaria be eliminated?</td>
<td>9</td>
</tr>
<tr>
<td><em>Stages of Elimination</em></td>
<td>9</td>
</tr>
<tr>
<td><em>Diagnostic testing &amp; surveillance</em></td>
<td>10</td>
</tr>
<tr>
<td><em>Preventative measures</em></td>
<td>11</td>
</tr>
<tr>
<td><em>Treatment response</em></td>
<td>12</td>
</tr>
<tr>
<td>How does the Asia Pacific collaborate to fight malaria?</td>
<td>13</td>
</tr>
<tr>
<td>Glossary and Key Phrases</td>
<td>14</td>
</tr>
<tr>
<td>References</td>
<td>15</td>
</tr>
</tbody>
</table>
QUICK FACTS FROM THE WORLD MALARIA REPORT 2014

SINCE 2001

- Malaria mortality rates have dropped 46% worldwide\(^1\)
- Prevalence of malaria in children has declined by 46% worldwide\(^1\)
- Number of people infected with malaria at any one time dropped 26%, from 173 million to 128 million worldwide\(^1\)

IN 2013

- Funds needed to achieve global malaria control and elimination targets: US$5.1bn\(^1\)
- Funds allocated by international and domestic funding sources: US$2.7bn, a gap of US$2.4bn\(^1\)
- An estimated 197 million people were tested for malaria by microscope examination\(^1\)
- An estimated 56–69 million children with malaria did not have access to a artemisinin-based combination therapy (ACT)\(^1\)

BY 2015

- Malaria mortality is projected to decrease 58% globally\(^2\)
- Malaria mortality in children under five is projected to decrease 69% globally\(^2\)
INTRODUCTION

Approximately 584,000 people died from malaria in 2013, 453,000 of whom were children under the age of five years old. Anybody can contract malaria, however, because the mosquito vector is difficult to control, areas of low resources and high poverty are most at risk. Malaria is a major public health issue in South America, sub-Saharan Africa, and in many countries in the Asia Pacific region.

Some survivors can expect severe health complications: compromised liver function, cerebral damage, joint damage and exhaustion. It is not only the individual that suffers however, their community and region feel the impact as well. Having malaria present in a population means valuable resources have to be diverted for prevention and treatment. The local economy is also affected because sick people are often removed from the workforce, forcing people further into poverty.

But, there is hope. We have the technology required to deal with malaria, all that remains is commitment and implementation.

With sustained financing, good management, community involvement, strong health systems, research and regional collaboration, malaria can be eliminated region by region until it is completely eradicated, like smallpox was in the past.

Currently in the Asia Pacific region there is a strong push to accelerate progress against malaria and to eliminate the disease in the region by 2030.
WHAT IS MALARIA? 

Malaria is a disease caused by the parasite *Plasmodium* which gets into the bloodstream of humans and animals through the bites of female *Anopheles* mosquitoes. There are four main species of *Plasmodium*: *Plasmodium vivax* (*P.vivax*), *Plasmodium ovale* (*P.ovale*), *Plasmodium falciparum* (*P. falciparum*) and *Plasmodium malariae* (*P.malariae*).

Only the female mosquito can transmit the disease, as only females are able to harbour the parasite. When feeding, the female *Anopheles* mosquito can extract or insert the parasite into the blood of the recipient, which is how malaria is transmitted between individuals. An infected individual is termed the ‘host’.

SYMPTOMS OF MALARIA INCLUDE FEVER, DISORIENTATION, HEADACHE, ANAEMIA, JOINT PAIN AND IN SOME CASES, DEATH.

Not all species of malaria behave in the same way. *P. vivax* can be present in humans without causing any symptoms (known as an asymptomatic infection), by ‘hiding’ in the liver. While it is asymptomatic, *P. vivax* can persist in a population without detection, before re-emerging and causing a new round of infections. *P. falciparum* can also be asymptomatic.

After infection, the parasite lives in the cells of the liver, where it multiplies, until it eventually ruptures into the bloodstream, where it infects red blood cells.

Malaria can only be detected when the parasite is present in the blood stream.

*Plasmodium knowlesi* (*P. knowlesi*) is a species of malaria that is mostly confined to a few species of macaques, that is increasingly infecting humans, with approximately 2500 confirmed cases (66% of the total) in Malaysia in 2014.

Diagram showing the lifecycle of the malaria parasite. NIH NIAID, 2015 (modified)
HOW IS MALARIA TREATED?

Treating malaria effectively requires medical intervention. Current WHO guidelines recommend ‘artemisinin-combination therapy’ (ACT) for the treatment of malaria. ACT relies on a combination of 2-3 medications to wipe out the parasites within the host. The following medications are commonly used in the Asia Pacific region:

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>EFFECT</th>
<th>ADMINISTERED TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artemisin-based combination therapy (ACT)</td>
<td>Artemisin reduces parasite load in the blood. Partner drug in combination eradicates remaining parasites.</td>
<td>Confirmed cases and to a vulnerable population as a part of mass drug administration (see page 12)</td>
</tr>
<tr>
<td>Primaquine (in combination with ACT)</td>
<td>Targets the gametocytes of the parasite in the bloodstream.</td>
<td>Confirmed cases</td>
</tr>
</tbody>
</table>

DRUG RESISTANCE

Drug resistance occurs as a natural process when one toxin is applied to a large population of organisms. Eventually, a small group of pathogens will evolve to not be affected by the drugs used against them. This has occurred in the case of malaria. Because malaria is so widespread, and because there are few medications that are effective against it, drug resistance is a looming threat. Currently, five countries in the Greater Mekong Subregion report *P. falciparum* displaying resistance to artemisinin, and there have been numerous cases of resistance to ACT as well. The WHO recommends combinations of therapies to battle resistance. For *P. vivax* infections, primaquine is required to clear the parasite from the liver.
The Asia Pacific is one of 3 main regions that still has high numbers of malaria cases (the others are Latin America and Africa).

Countries in the Asia Pacific see cases of malaria predominantly from the \textit{P. vivax} and \textit{P. falciparum} parasites. \textit{P. vivax} infections have a higher occurrence in the Asia Pacific region, which comprises 44% of cases, compared with 8% in the rest of the world\cite{1}.

\textit{P. vivax} and \textit{P. falciparum} can be asymptomatic, so they have the highest risk of transmission: people who are unaware they have malaria do not seek treatment and can act as a reservoir of the disease in an otherwise healthy population\cite{8}.

\textbf{THE DIFFERENCE IN POPULATION DYNAMICS, AVAILABILITY OF RESOURCES AND GEOGRAPHICAL FACTORS ACROSS THE REGION AFFECT THE INCIDENCE AND SEVERITY OF MALARIA OUTBREAKS.}
HOW CAN MALARIA BE ELIMINATED?

Malaria elimination is defined as the reduction to zero of infections caused by the malaria parasite in a defined geographical area as a result of deliberate efforts. This is contrasted with malaria control, which involves managing the disease vector, and malaria eradication, which requires permanent reduction to zero of malaria infections worldwide. Malaria elimination has been shown on many occasions to come with significant benefits. These benefits can come in the form of higher work productivity or economic growth when malaria infections are reduced. Many studies have been done that show the cost-benefit analysis of malaria elimination is very favourable. It has been estimated that there would be a $4 trillion increase in economic output if malaria was eliminated, compared to just controlled.

STAGES OF ELIMINATION

The WHO has outlined the milestones a country or region must reach to gain ‘elimination status’, outlined in the figure above. When the Slide Positivity Rate (SPR), a measure of how many infections are detected using microscopy, goes below five in cases of fever, the country can move to ‘pre-elimination’. The ‘elimination phase requires less than one case per year. Before a country is declared ‘malaria-free’ by the WHO, there must not be any locally-acquired cases of malaria for three years.

COUNTRIES MUST ACHIEVE PRE-ELIMINATION STATUS BEFORE ELIMINATION CAN BE ATTEMPTED

Several factors have to be considered before a country can implement a successful elimination program:

- Financial viability: Are there enough financial resources available to complete a full elimination program?
- Operational feasibility: Are the methods feasible? Is the infrastructure available? Will the population be reachable?
- Commitment of the government: Is the government committed to seeing out a full elimination program?
- Importation Risk (vulnerability): How likely is it for malaria to be brought in to a malaria-free area from nearby?
- Outbreak Risk (receptivity): How likely is transmission in an area or how likely is an outbreak?
Efficient diagnosis of malaria is essential if the elimination status of a population is to be maintained.

There are two main methods for diagnosing a malaria infection:

- **Rapid Diagnostic Test (RDT):** provides quick diagnosis of malaria in the field. RDTs work by detecting particular components of the *Plasmodium* parasite. They are also quite simple to use so that more people in the community can be trained to use them\(^\text{12}\).

- **Microscopy:** Trained individuals study blood samples of suspected cases for evidence of *Plasmodium* infection. Microscopy is needed to move into the elimination phase so training and motivation of microscopists is vital.

Good diagnosis is essential to malaria surveillance. A malaria surveillance system consists of the tools, procedures, people and structures that generate information on malaria cases and deaths, which can be used for planning, monitoring and evaluating malaria control programmes. Through accurate diagnosis governmental bodies and NGOs can monitor emerging cases and ensure that there is an appropriate response by the health system. Through appropriate response, it is possible to limit the potential of transmission and outbreaks of malaria\(^\text{13}\).

Unfortunately, it is those areas that have little or no national surveillance in place that are the worst affected by malaria. Only 10% of all estimated 198 million malaria cases in 2013 were reported to national surveillance programs\(^\text{1}\).
PREVENTATIVE MEASURES

Several preventative approaches can be used to lower the risk of malaria transmission.

Understanding mosquito vector behaviour

Understanding mosquito behaviour can enable populations to avoid times and locations where there is peak mosquito activity, thereby reducing their chance of being bitten. Research and education is essential to this method. There are many different mosquito behaviours that are relevant to their role as a vector, which change species-to-species:

- Mosquitoes may bite indoors (endophagic), outdoors (exophagic), or both
- Mosquitoes may rest indoors (endophillic), outdoors (exophillic), or both
- Mosquitoes may be active at dawn or dusk (crepuscular) or at night time (nocturnal)
- Mosquitoes may only feed on human blood (anthropophagic), or on animal blood (zoophagic), or both

Targeting of preventative measures to mosquito behaviour can alter the behaviour of mosquitoes as vectors. The ability for the elimination program to adapt to behavioural changes has to be in place to ensure there is no resurgence of malaria.

Indoor residual spraying (IRS)

The application of insecticides to potential mosquito resting surfaces, reducing their lifespan and vector capacity. The successful use of IRS is dependent on consistent application and insecticide accessibiility.

Long-lasting insecticidal nets (LLIN)

The use of bed nets prevents the mosquito from biting people as they sleep. When coated with insecticide, they are also able to reduce the population of mosquitos within a dwelling.
TREATMENT RESPONSE

Certain regions in the Asia Pacific are at a higher risk of developing malaria outbreaks, as they do not have adequate access to the resources and services required to control malaria effectively. There are several strategies when it comes to controlling malaria in higher-risk areas and during outbreaks.

Individual treatment

Treatment can be provided to the infected individual (curative) and the at-risk population that surrounds them (preventative). However, the use of drugs can eventually lead to resistance of the parasite, making the treatment ineffective. Treatment effectiveness is also impacted by when it is administered. Treatment closest to the initial infection will be most effective, highlighting the need for easily accessed and more sensitive diagnostic procedures.\textsuperscript{12, 15}

Public health strategies

Directly observed treatment (DOT):

Administering malaria treatment to patient while they are being directly supervised. DOT ensures adherence to the treatment regimen, and has been shown to be more effective in treating the disease. However, this method requires more work hours for the clinicians or community volunteers, and is logistically more difficult to organise.

Mass drug administration (MDA):

Administering treatment to a susceptible population regardless of whether individuals have been confirmed as having malaria. Targeted MDA has been considered a potential tool for areas where artemisinin resistance has been found.\textsuperscript{6} However, targeted MDA is a controversial method, and is not often recommended.

Mass screening and treatment (MSAT):

The screening of all individuals in a population regardless whether individuals report symptoms and treatment being administered to those that test positive. However, this scheme depends on the ability to reach the whole population being targeted. It is also expensive, requiring skilled professionals and equipment to carry out the program.

Intermittent preventative treatment (IPT):

Regular administration of anti-malarial drugs to prevent the emergence of new infections (prophylaxis) and to clear existing parasites from individuals. The WHO currently recommends IPT, especially for pregnant women, in all areas that have high malaria transmission risk,\textsuperscript{16} but it is not commonly used in the Asia Pacific region.
HOW DOES THE ASIA PACIFIC COLLABORATE TO FIGHT MALARIA?

Malaria is a disease without borders, and is endemic to 22 countries in the Asia Pacific region. Regional commitment and collaboration has been vital to the unprecedented progress towards reducing the number of malaria cases and deaths in the Asia Pacific. This success has given the region the encouragement needed for the ambitious but achievable goal of malaria elimination by 2030.

There are many organisations operating in the Asia Pacific that aim to promote intra-regional and inter-governmental cooperation, which is vital for elimination efforts to succeed:

**ADB — Asia Development Bank ([www.adb.org](http://www.adb.org))**

The Asian Development Bank aims for an Asia and Pacific free from poverty. ADB aims to achieve this with the recent establishment of the Malaria and Other Communicable Disease Threats Trust Fund.

**APLMA — Asia Pacific Leaders’ Malaria Alliance ([www.aplma.org](http://www.aplma.org))**

An alliance of Asian and Pacific government heads which aims to accelerate progress towards malaria elimination with the end goal of malaria elimination by 2030.

**APMEN — Asia Pacific Malaria Elimination Network ([www.apmen.org](http://www.apmen.org))**

APMEN is a network owned and led by 18 Country Partners in the Asia Pacific region who currently share a common goal to eliminate malaria.

**The WHO Western Pacific and South-East Asia Regional offices**

The WHO aims to support countries in achieving the highest health standards possible and to lead responses to health issues.

**RBM — Roll Back Malaria ([www.rollbackmalaria.org](http://www.rollbackmalaria.org))**

A global partnership for implementing coordinated action against malaria, which aims to connect malaria endemic countries with collaborators in the private, governmental, NGO, research and academic spheres.
GLOSSARY AND KEY PHRASES

**Active case detection**: when an individual seeks out diagnosis on their own accord and is tested positive as result.

**Anaemia**: fatigue and pallor caused by a deficiency of red blood cells or haemoglobin in the blood.

**Anopheles**: the species of mosquito that carries the Plasmodium parasite. Acts as a vector of the disease.

**Asymptomatic**: when a host is infected, but does not display any disease symptoms.

**Confirmed case**: a patient that displayed symptoms of malaria and has tested positive using RDT or microscopy.

**Drug resistance**: when a pathogen (like the malaria parasite) becomes able to tolerate the medications designed to kill it. Drug resistance occurs as pathogens evolve to survive common treatments, and is made worse by improper treatment use or high levels of a single treatment type.

**Elimination**: reduction to zero of the incidence of infection caused by a specified malaria parasite in a defined geographical area as a result of deliberate efforts.

**Eradication**: the reduction of an infectious disease’s prevalence in the global host population to zero.

**Estimated cases**: extrapolated estimates based on reported cases for a region.

**Gametocytes**: Merozoites can develop into gametocytes which are able to make the transition between human and mosquito hosts.

**Host**: an organism infected with malaria.

**Hotspots**: the surrounding population that is vulnerable to the re-emergence of Malaria due to a confirmed or suspected case within the community.

**Imported cases**: malaria cases that are found in an area, but were not caused by local mosquitoes, but rather were brought in by the host from another area.

**Importation Risk (vulnerability)**: the risk of malaria re-introduction due to a non-malarious area being in proximity to a malarious area and the movement of people and behaviour of the Anopheles species.

**Insecticide resistance**: when mosquitoes become resistant to the pesticides sprayed to remove them from an area.

**Merozoites**: the stage of the Plasmodium life cycle that is present in the bloodstream and infects red blood cells causing symptoms of the disease.

**Microscopy**: blood samples taken from suspected Malaria cases and studied by experienced scientists under a microscope for the presence of Plasmodium parasites.

**Outbreak Risk (receptivity)**: the likelihood of transmission to occur in an area or the capability of a case of malaria to give rise to an outbreak in an area of elimination.

**Passive case detection**: when an individual is tested positive due to being tested as a result of a Public Health strategy and was not actively seeking out diagnosis.

**Plasmodium spp**: the species of parasite that causes malaria.

**Pre-elimination status**: WHO recommends the pre-elimination status be deemed when the incidence of malaria is less than 5 per 1000 people at risk.

**P. vivax**: a species of Plasmodium parasite that is common in the Asia Pacific Region.

**P. falciparum**: a common species of Plasmodium in the African Region that is also common in the Asia Pacific Region.

**Rapid Diagnostic Testing**: an immediate diagnostic test for malaria in which a coloured line indicates the presence of Plasmodium in the bloodstream.

**Reported cases**: cases reported to the WHO, based on confirmed infections

**Resistance**: see Insecticide resistance, Drug Resistance

**Sensitivity**: proportion of people with malaria infection that have a positive test result (true positives).

**Specificity**: proportion of people without malaria infection who have a negative test result (true negatives).

**Transmission**: the transference of infection from one individual to another.

**Vector**: the environmental or biological method a pathogen uses to move between hosts. Malaria’s vectors are mosquitoes in the Anopheles genus.

**Vector capacity**: the expected number of infectious bites that will arise from all the mosquitoes that bite a single person in one day.

**Vector control**: methods to limit or eradicate the organism responsible for the transmission of disease between individuals.
REFERENCES


The Asia Pacific Malaria Elimination Network (APMEN) is composed of 18 Country Partners in the Asia Pacific region who currently share a common goal to eliminate malaria, either at the national or sub-national level. Development of APMEN took place in 2008, and APMEN is managed by a Joint-Secretariat from the Global Health Group at the University of California, San Francisco, and the School of Public Health at the University of Queensland. Major funding for APMEN is provided by the Australian Government’s Department of Foreign Affairs and Trade (DFAT).

www.apmen.org

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