

ELIMINATING MALARIA



World Health
Organization

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Foreword

Each year, the World Health Organization and our partners unite around a common theme for World Malaria Day. This year's theme – “End Malaria for Good” – reflects the vision of a world free of malaria set out in the *Global Technical Strategy for Malaria 2016-2030*.

This strategy, adopted by the World Health Assembly in May 2015, was the result of an extensive consultative process involving 400 malaria experts from more than 70 countries. It sets ambitious but attainable goals aimed at dramatically lowering the global malaria burden in the next 15 years. They include:

1**REDUCING MALARIA CASE INCIDENCE BY AT LEAST 90%****2****REDUCING MALARIA MORTALITY BY AT LEAST 90%****3****ELIMINATING MALARIA IN AT LEAST 35 COUNTRIES****4****PREVENTING THE RE-ESTABLISHMENT OF MALARIA IN ALL COUNTRIES THAT ARE MALARIA-FREE**

This report, presented on World Malaria Day 2016, focuses on the third goal: malaria elimination. It offers a brief analysis of recent country-level progress towards elimination and spotlights countries that are poised to reach the finish line in the next five years.

A number of countries have had remarkable success in controlling malaria, and these achievements are hard-won. But in many respects, the hardest work is yet to come. Our report highlights the considerable challenges countries will face in their efforts to drive down malaria cases to zero and to prevent resurgences of this deadly disease.

Dr Pedro Alonso

*Director, Global Malaria Programme
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A quick primer on malaria

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female *Anopheles* mosquitoes. There are five parasite species that cause malaria in humans, and two of these species, *Plasmodium falciparum* and *Plasmodium vivax*, pose the greatest threat.

P. falciparum

is the most prevalent malaria parasite on the African continent and responsible for most malaria deaths globally.

P. vivax

is the dominant malaria parasite in most countries outside of sub-Saharan Africa.

Symptoms of malaria – including fever, headache, chills and vomiting – typically appear 10 to 15 days after the infective mosquito bite. Without treatment, *P. falciparum* malaria can progress to severe illness and death.

In countries with high rates of malaria transmission, young children and pregnant women are particularly vulnerable to the severe consequences of infection, including death. Outside of highly endemic areas, where populations do not acquire significant immunity to malaria, the risk of the disease is spread across all age groups and depends on the level of exposure to mosquito bites.

Background

In 1955, the World Health Organization (WHO) launched the Global Malaria Eradication Programme (GMEP), an ambitious plan to eradicate malaria worldwide. The Programme relied heavily on two tools: the drug chloroquine for prevention and treatment of malaria and the chemical DDT for mosquito control.

Over the course of the GMEP era, 15 countries and one territory eliminated malaria (Table 1). A number of other countries succeeded in greatly reducing their malaria burden.¹ But no major success occurred in sub-Saharan Africa and, in many settings, a failure to sustain the Programme resulted in resurgences of malaria. In 1969, GMEP was discontinued, but the longer-term objective remained unchanged. WHO reaffirmed the “ultimate goal of eradication” at the Twenty-second World Health Assembly through resolution WHA22.39.

The next two decades saw a marked increase in malaria incidence worldwide – a result of the abandonment of GMEP and of reduced investment in malaria control. Following the economic crisis of the early 1970s, funding for malaria control was cut further. In parallel, a rise in mosquito resistance to DDT and parasite resistance to chloroquine was reported in some regions. In many areas, substantial gains in malaria control were lost in resurgences of the disease.

¹In India, for example, the reported number of malaria cases declined from an estimated 110 million in 1955 to less than 1 million in 1968. Sri Lanka reduced its incidence of malaria from an estimated 2.8 million cases in 1946 to a reported 18 cases in 1966.

TABLE 1.
Countries certified as malaria-free by WHO (1955-2015) and future elimination targets

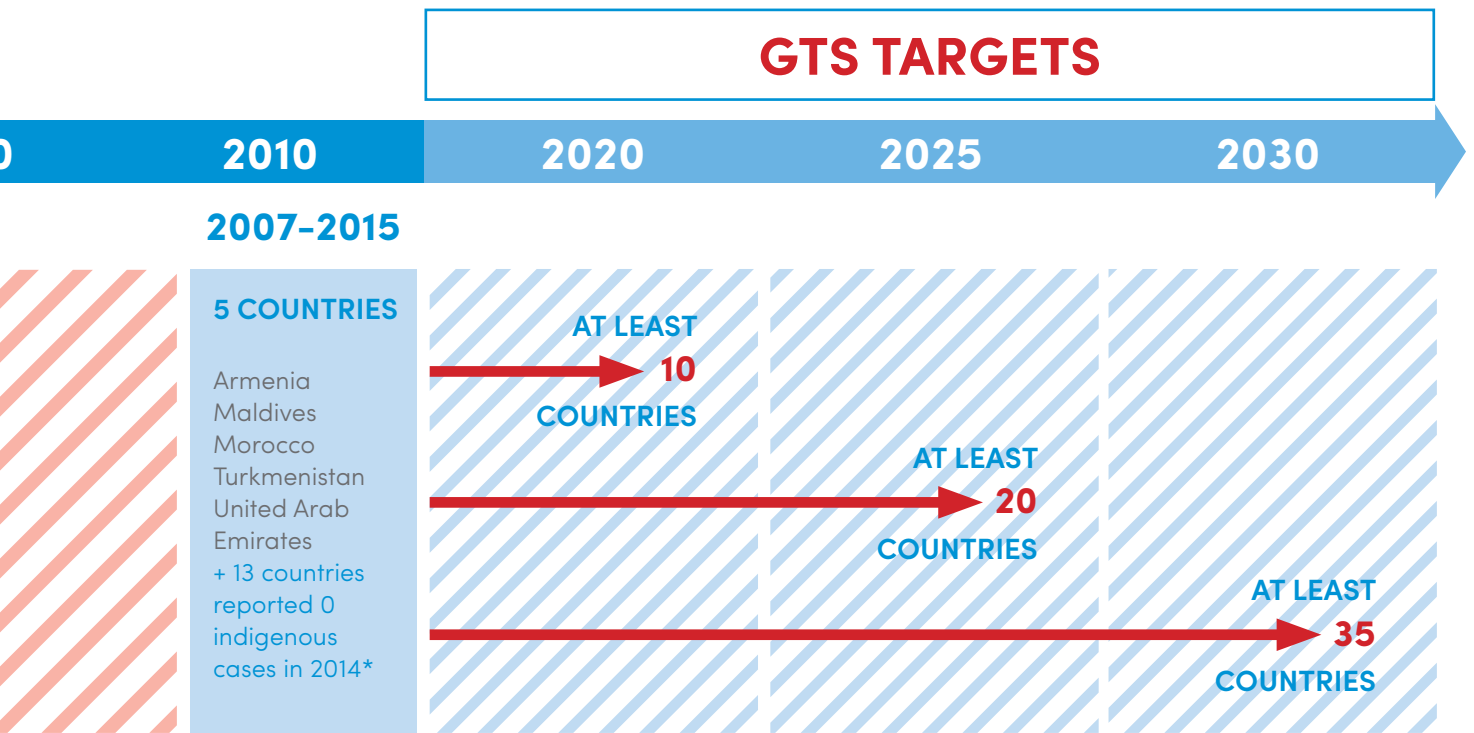
1955-1969				
GLOBAL MALARIA ERADICATION PROGRAMME				
1960	1970	1980	1990	2000
1955-1972		1972-1987		1987-2007
15 COUNTRIES AND 1 TERRITORY Bulgaria, Cyprus, Dominica, Grenada, Hungary, Italy, Jamaica, Netherlands, Poland, Romania, Saint Lucia, Spain, Taiwan, Trinidad and Tobago, United States of America, Venezuela		7 COUNTRIES AND 1 TERRITORY Australia, Brunei, Cuba, Mauritius, Portugal, Réunion, Singapore, Yugoslavia (Bosnia Herzegovina, Croatia, The former Yugoslav Rep. of Macedonia, Montenegro and Serbia)		NONE

GTS elimination targets: The Global Technical Strategy for Malaria (GTS) calls for the elimination of malaria in at least 10 countries by 2020. To meet this target, a country must achieve at least one year of zero indigenous cases by 2020. According to the WHO analysis presented in this report, 21 countries have the potential to reach this target: Algeria, Belize, Bhutan, Botswana, Cabo Verde, China, Comoros, Costa Rica, Ecuador, El Salvador, Iran (Islamic Republic of), Malaysia, Mexico, Nepal, Paraguay, Republic of Korea, Saudi Arabia, South Africa, Suriname, Swaziland and Timor-Leste.

RENEWED POLITICAL AND TECHNICAL LEADERSHIP

A Ministerial Conference on Malaria, convened by WHO in 1992, marked a turning point in global efforts to contain the disease. In view of the increasing gravity and complexity of malaria, senior health leaders from 65 countries called for a renewed attack on malaria. A new WHO Global Malaria Control Strategy, endorsed by the Conference, was adopted the following year by the World Health Assembly.

In 1998, WHO, the World Bank, the United Nations Development Programme (UNDP) and the United Nations Children’s Fund (UNICEF) created the Roll Back Malaria initiative with the goal of halving the global burden of malaria by 2010. Two years later, leaders of malaria-endemic countries in Africa signed the



Certification of malaria elimination: Countries that achieve at least three consecutive years of zero indigenous cases are eligible to apply for a WHO certification of malaria-free status. Between 1955 and 2015, 27 countries and two territories received this WHO certification. Three countries recently started the certification process: Argentina, Kyrgyzstan and Sri Lanka.

***Zero indigenous cases:** In 2014, 13 countries reported 0 indigenous cases of malaria. They are: Argentina, Azerbaijan, Costa Rica, Georgia, Iraq, Kyrgyzstan, Oman, Paraguay, Sri Lanka, Syrian Arab Republic, Tajikistan, Turkey and Uzbekistan.

Abuja Declaration on Roll Back Malaria in Africa, which aimed to reduce malaria mortality on the African continent by 50% by the year 2010.

In 1997, the Multilateral Initiative on Malaria brought together prominent scientists and key funding organizations to identify priority research areas for malaria.² Over the next decade, increased investment in research yielded the development of highly effective malaria control tools – notably, long-lasting insecticide-treated nets (LLINs), rapid diagnostic tests (RDTs), and artemisinin-based combination therapies (ACTs).

The creation of the Global Fund to Fight AIDS, Tuberculosis and Malaria, the President's Malaria Initiative and other financing mechanisms allowed for the wide-scale deployment of these new tools.³ Between 2005 and 2014, global investment for malaria control increased from US\$ 960 million to US\$ 2.5 billion annually.

² This conference was held in Dakar, Senegal from 6-9 January 1997.

³ The Global Fund and the President's Malaria Initiative (PMI, an initiative of the Government of the United States of America) were launched in 2002 and 2005, respectively.

IMPACT OF MALARIA CONTROL TOOLS

The massive rollout and use of these core malaria control tools led to a dramatic decline in the global malaria burden. According to WHO estimates, malaria incidence (the rate of new malaria cases) fell by 37% between 2000 and 2015. The malaria-focused target of the 2000 Millennium Development Goals, which called for halting and beginning to reverse the global incidence of malaria by 2015, has been achieved.

Since 2000, malaria mortality rates have declined by 60% globally. Among children under 5 years of age, malaria death rates fell by 65%. In the WHO African Region, where the disease is heavily concentrated, malaria mortality rates fell by 66% among all age groups and by 71% among children under 5 years.

A LONG ROAD AHEAD

But the fight is far from over. About 3.2 billion people – nearly half the world’s population – remain at risk of malaria. In 2015 alone, there were 214 million new cases of the disease and more than 400 000 malaria-related deaths. Millions of people around the world are still not accessing the health services they need to prevent and treat malaria.

Global progress in malaria control masks disparities between and within countries. The African Region continues to shoulder the heaviest burden: in 2015, this one Region accounted for approximately nine in 10 malaria cases and deaths globally. Two countries, Nigeria and the Democratic Republic of the Congo, together account for more than 35% of global malaria deaths.

As the global malaria burden declines, emerging biological threats have the potential to seriously weaken malaria responses in many parts of the world. In 2014, 60 countries reported mosquito resistance to at least one insecticide used in nets and indoor residual spraying.⁴ Parasite resistance to artemisinin, the core compound of the best available antimalarial medicines, has been detected in five countries of the Greater Mekong Subregion.

⁴ Out of 78 countries that monitored insecticide resistance in 2014 (World Malaria Report 2015).

GLOBAL STRATEGY

To address remaining challenges, the World Health Assembly adopted in 2015 the *Global Technical Strategy for Malaria 2015–2030 (GTS)*, a 15-year blueprint for malaria control and elimination. This WHO-led strategy is complemented by the advocacy plan *Action and Investment to Defeat Malaria 2016–2030 (AIM)*, developed by the Roll Back Malaria Partnership. Both documents share the same timeline as the 2030 Sustainable Development Goals.

The objectives of the Global Technical Strategy can be achieved only through robust, predictable and long-term financing: global investment will need to triple from current levels, reaching an estimated US\$ 8.7 billion annually by 2030. Progress can be accelerated through strong and sustained political commitment, increased multi-sectoral collaboration and continued investment in the development of new malaria control tools.

BOX 1.

Key definitions: control, elimination, eradication

WHO defines **malaria control** as the reduction of disease incidence, prevalence, morbidity or mortality to a locally acceptable level as a result of deliberate efforts. Continued intervention efforts are required to sustain control.

Malaria elimination is the interruption of local transmission (i.e. reducing the rate of malaria cases to zero) of a specified malaria parasite in a defined geographic area. Continued measures are required to prevent reestablishment of transmission.

Malaria eradication is defined as permanent reduction to zero of the worldwide incidence of infection caused by human malaria parasites as a result of deliberate efforts. Once eradication has been achieved, intervention measures are no longer needed.⁵

⁵ To date, only one infectious disease affecting humans has been eradicated: smallpox.

The path to malaria elimination

Countries and communities are situated at different points along the road to elimination. The rate of progress in a particular country will depend on the strength of its national health system, the level of investment in malaria control and a number of other factors, including biological determinants;⁶ the environment; and the social, demographic, political and economic realities of a particular country.

Malaria elimination efforts are driven by ministries of health in endemic countries. As countries approach elimination, they continue to receive technical support from WHO and partners and, in some cases, financial support from the Global Fund and other donors. However, most elimination efforts are financed largely through domestic resources.

In countries with high or moderate rates of malaria transmission, national malaria control programmes aim to maximize the reduction of malaria cases and deaths. This can be achieved by providing access to the WHO-recommended package of effective tools that prevent, diagnose and treat malaria for all people at risk of the disease.⁷ The metrics of success are reductions in malaria case incidence and in rates of malaria mortality.

As countries approach elimination, enhanced surveillance systems can help ensure that every infection is detected, treated and reported to a national malaria registry. Patients diagnosed with malaria should be treated promptly with effective antimalarial medicines for their own health and to prevent onward transmission of the disease in the community.

In some countries nearing elimination, a high proportion of cases are found among migrant and mobile populations living in hard-to-reach areas, often near international borders. Cases of the disease imported by visitors and migrants must be identified and treated rapidly.

⁶ This includes factors related to affected populations, the parasite and the vectors (in the case of malaria, *Anopheles* mosquitoes).

⁷ This package of tools – including quality-assured vector control, chemoprevention, diagnostic testing and treatment of confirmed malaria cases – can dramatically reduce morbidity and mortality.

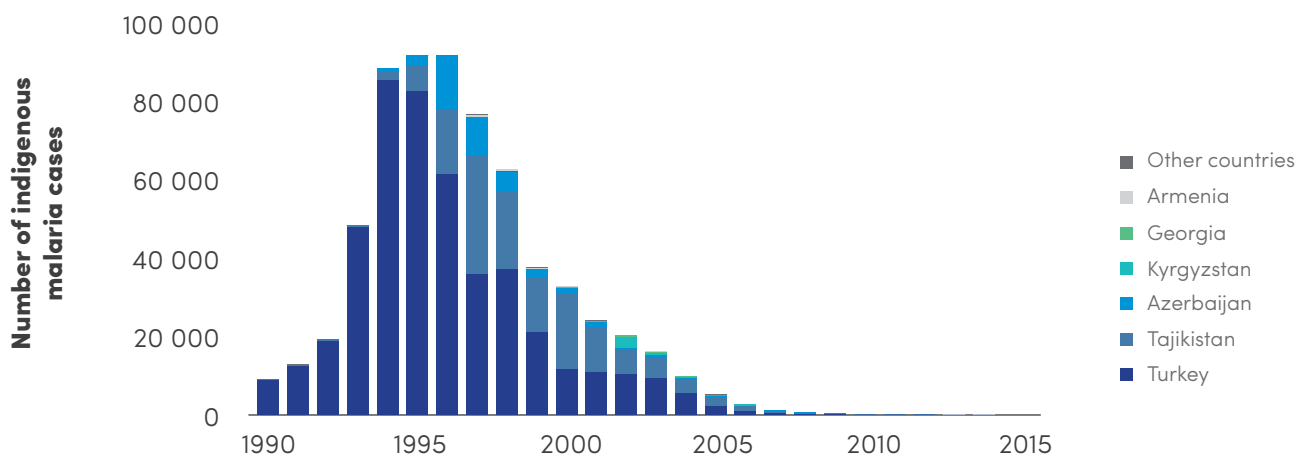
Elimination in Europe

In 1975, the WHO European Region,⁸ excluding Turkey, was considered malaria free. By the late 1980s and early 1990s, local malaria transmission had been re-established in the Caucasus, the Central Asian republics and, to a lesser extent, the Russian Federation, following the war in Afghanistan and the dissolution of the Soviet Union. In Turkey, a sharp increase in malaria cases in the 1990s has been linked to the large influx of Iraqi refugees during the First Gulf War; in 1994, the country reported a peak of 84 000 cases of the disease.

By the year 2000, malaria control efforts had succeeded in greatly reducing the burden of disease across the European Region; eight countries in the Region reported just over 32 000 cases of malaria. In 2005, only 5000 cases of malaria were reported regionwide. The goal of malaria elimination was within reach.

Through the 2005 Tashkent Declaration, leaders of affected countries made a joint regional pledge to eliminate malaria by 2015. This goal was achieved: in 2010, 179 cases of malaria were reported in six countries; in 2014, indigenous transmission was confined only to Tajikistan; and, in 2015, all countries in the European Region reported zero indigenous cases of malaria (Fig. 1).

FIGURE 1.
Achieving zero indigenous cases in the WHO European Region



⁸ The WHO European Region covers all countries of the European Union, the Balkans, South Caucasus and Central Asia as well as the Russian Federation, Israel and Turkey (53 countries in all).

The elimination success in the European Region was made possible through high-level political support, intense programmatic efforts in affected countries, WHO technical support and financial assistance from the Global Fund. It is an extraordinary – but fragile – achievement. The Region remains exposed to imported cases of malaria, particularly along the border between Afghanistan and Tajikistan.

Maintaining zero cases in the European Region will require sustained political commitment and constant vigilance. Any new cases of the disease must be promptly identified and treated. Health systems should be strengthened to ensure that any resurgence is rapidly contained.

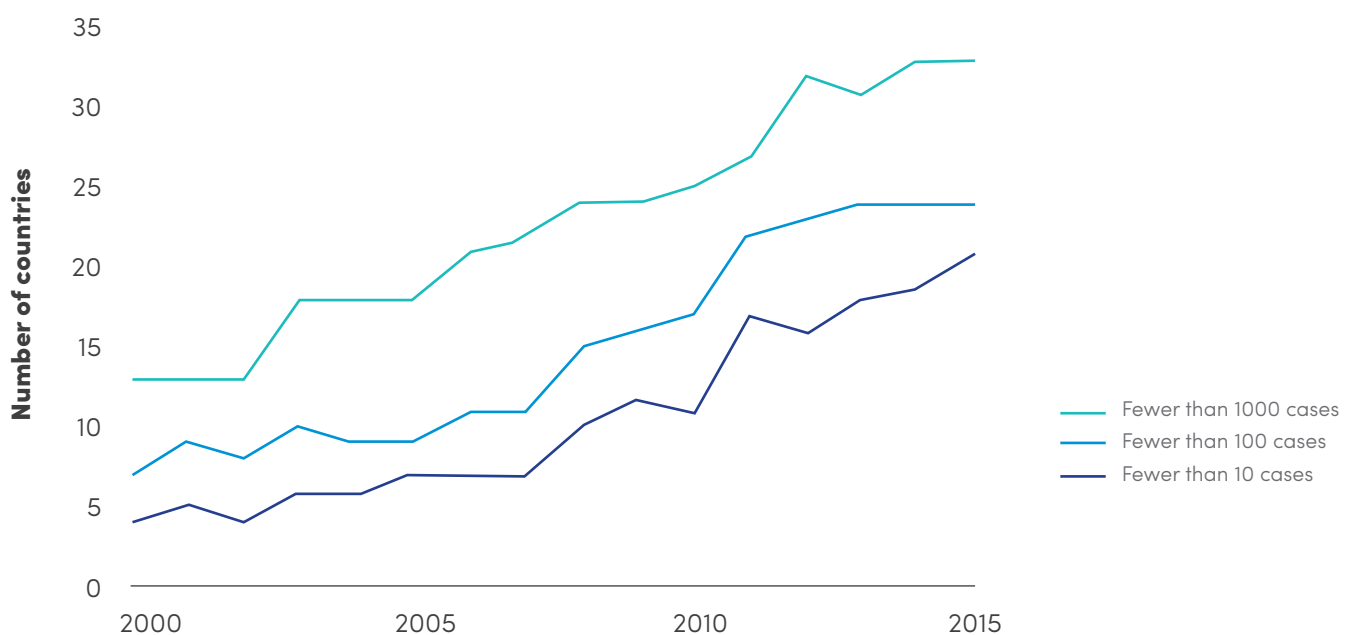
Country progress: 2000–2015

More than half (57) of the 106 countries with malaria in 2000 had achieved reductions in new malaria cases of at least 75% by 2015. During this same period of time, 18 countries reduced their malaria cases by 50–75%.

As illustrated in Figure 2, the number of countries moving towards malaria elimination is increasing. In 2000, an estimated 13 countries had fewer than 1000 cases of malaria; by 2015, 33 countries had achieved this milestone. Similarly, the number of countries with fewer than 100 cases of malaria, and with fewer than 10 cases of the disease, has increased sharply since 2000.⁹

Of the 13 countries with fewer than 1000 malaria cases in the year 2000, four have been certified as malaria-free: Armenia, Morocco, Turkmenistan and United Arab Emirates. An additional six countries reported zero indigenous cases of malaria in 2014: Argentina, Georgia, Kyrgyzstan, Oman, Syrian Arab Republic and Uzbekistan.

FIGURE 2.
Country progress towards malaria elimination, 2000–2015



⁹ This category includes countries that have reported zero indigenous cases of malaria since 2000 but that have not been certified as malaria-free by WHO.

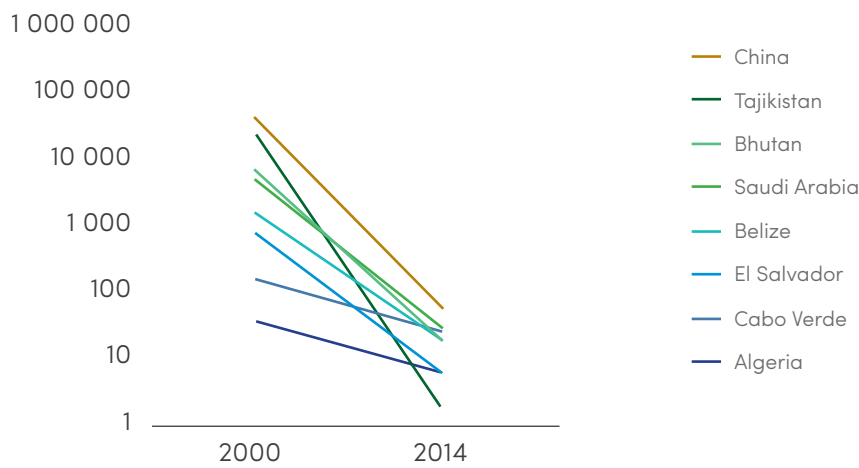
Country prospects for elimination by 2020

The Global Technical Strategy calls for the elimination of malaria in at least 10 countries by 2020. Table 2 lists the countries that, according to a WHO analysis, have the potential to achieve this target. This analysis is based on three criteria: (1) the total number of indigenous malaria cases reported by countries from 2000 to 2015 (Fig. 3); (2) the declared malaria objectives of affected countries; (3) the informed opinions of WHO experts in the field.

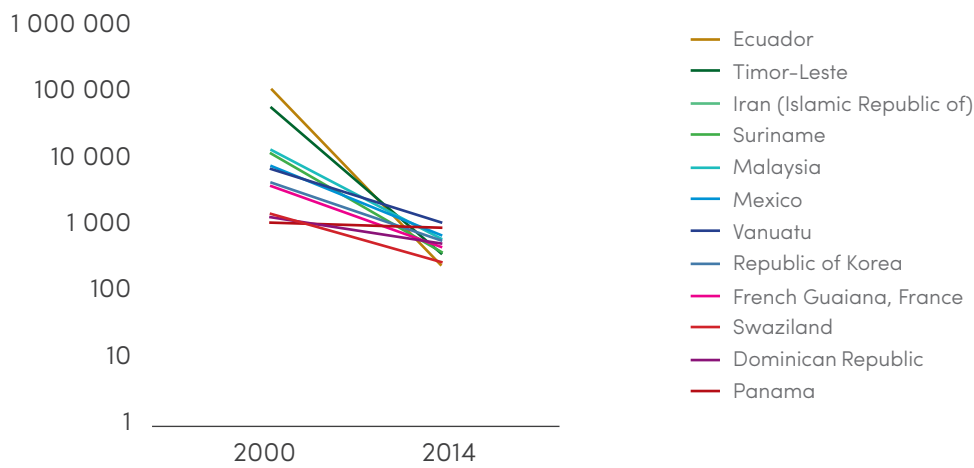
TABLE 2.
WHO analysis: Countries with the potential to eliminate local transmission of malaria by 2020, by WHO region

African Region	Algeria, Botswana, Cabo Verde, Comoros, South Africa, Swaziland
Region of the Americas	Belize, Costa Rica, Ecuador, El Salvador, Mexico, Paraguay, Suriname
Eastern Mediterranean Region	Iran (Islamic Republic of), Saudi Arabia
South-East Asia Region	Bhutan, Nepal, Timor-Leste
Western Pacific Region	China, Malaysia, Republic of Korea

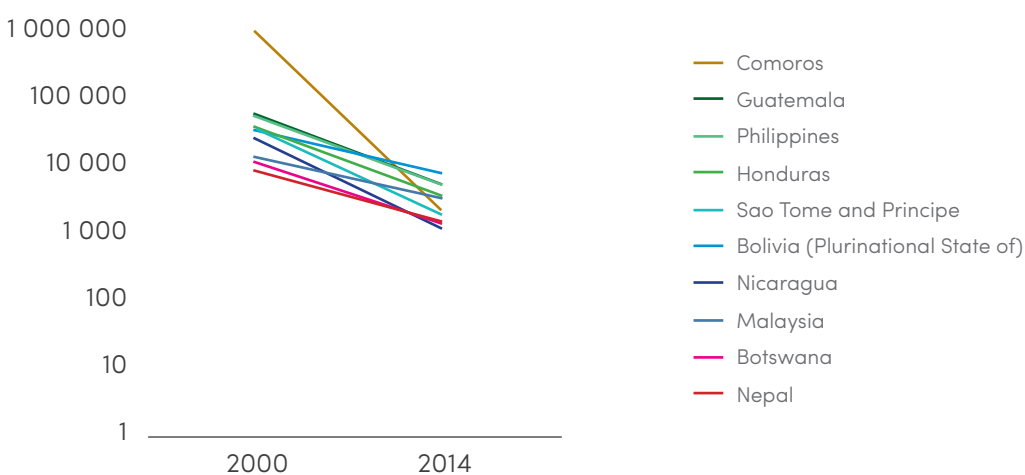
FIGURE 3.
Countries with fewer than 100 indigenous malaria cases in 2014



Countries with 100 to 1000 indigenous malaria cases in 2014¹⁰



Countries with 1000 to 10 000 indigenous malaria cases in 2014

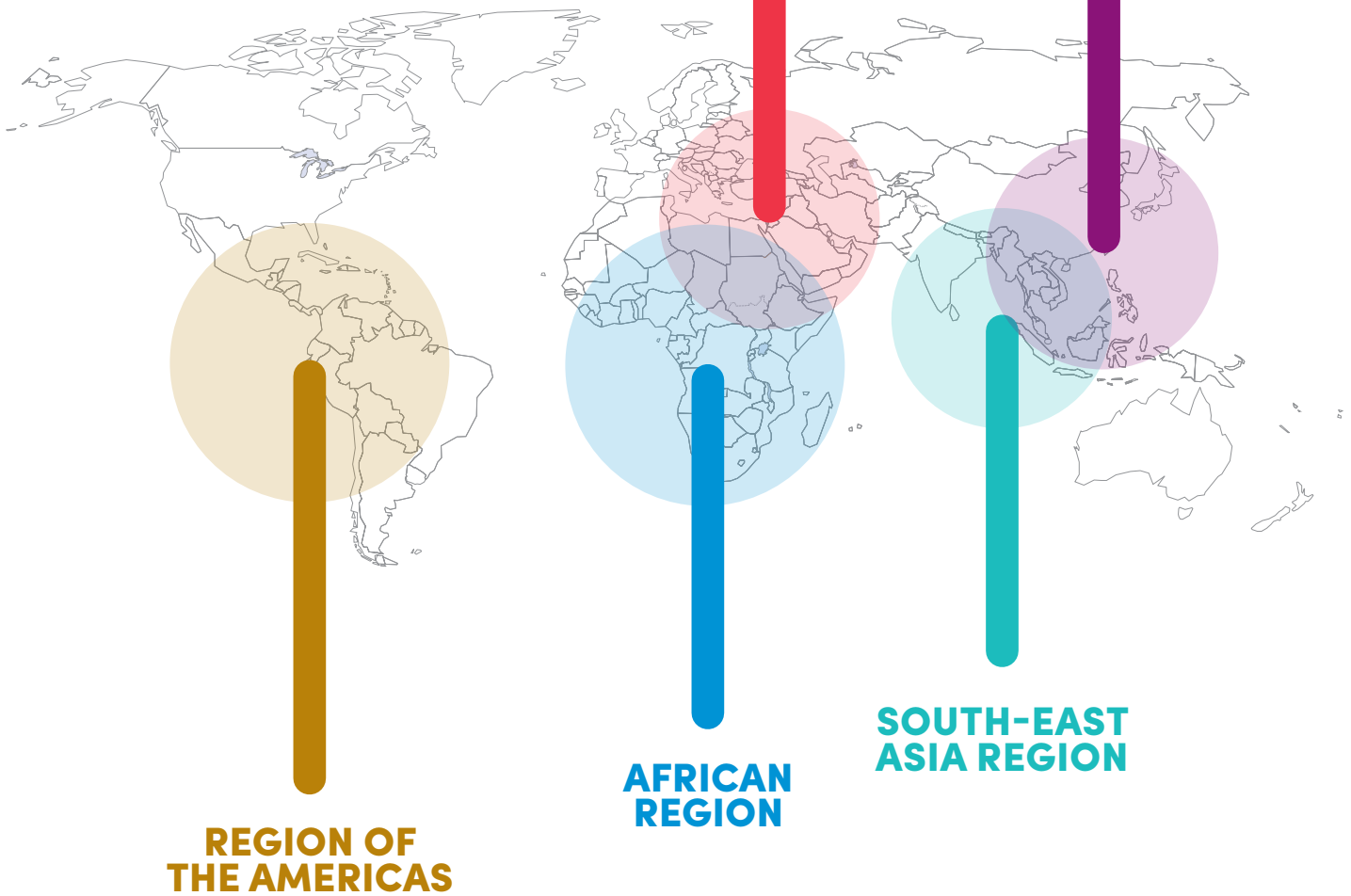


¹⁰ The number of malaria cases shown for Malaysia in this table includes those caused by *P. falciparum* and *P. vivax* but excludes *P. knowlesi* cases.

Country highlights

**EASTERN
MEDITERRANEAN
REGION**

**WESTERN PACIFIC
REGION**



**REGION OF
THE AMERICAS**

**AFRICAN
REGION**

**SOUTH-EAST
ASIA REGION**

Note: In 2014, Vanuatu, Sao Tome and Principe and French Guiana reported fewer than 1000 cases of malaria. All three are currently expected to eliminate malaria by 2025. However, with adequate financing and political will, they have the potential to eliminate malaria by 2020.

AFRICAN REGION



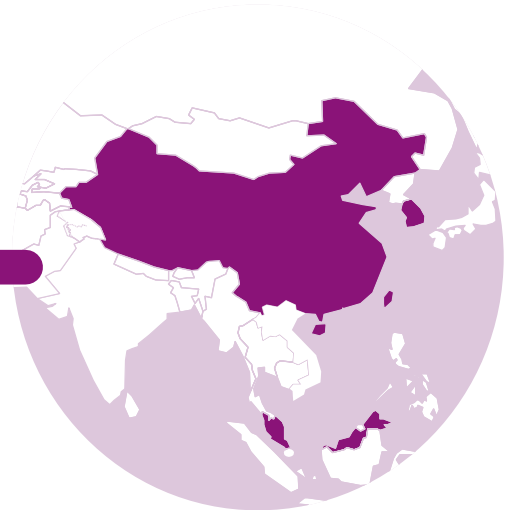
- **Algeria** reported zero indigenous cases of malaria in 2014 and 260 imported cases of the disease.¹¹ The risk of malaria is limited to small areas in the southernmost part of the country located along a trans-Saharan migration route.
- In 2014, **Cabo Verde**, a group of 10 islands off the coast of Western Africa, reported only 46 cases of malaria, of which 20 were imported. In the island nation of **Comoros**, located off the south-eastern coast of Africa, malaria cases fell from an estimated 53 000 in 2013 to just over 2000 in 2014. This sharp decline followed a massive effort that included both a treatment campaign and the distribution of long-lasting insecticide-treated nets.¹²
- In southern Africa,¹³ **Swaziland** is leading the path to elimination, with 710 confirmed cases of malaria reported in 2014. As the country works to drive down its malaria cases to zero, cross-border collaboration will be critical: approximately half of the cases investigated in 2014 were imported from other countries. **Botswana** has achieved a substantial reduction in malaria cases since the beginning of this millennium: from approximately 71 000 cases in 2000 to 1485 cases in 2015.
- **South Africa** has set a national target to eliminate malaria by 2018. In 2014, the country reported nearly 11 700 cases of malaria, down from more than 64 000 cases in 2000. The country's relatively high number of malaria cases are geographically concentrated along the border with Zimbabwe, Swaziland and Mozambique. Through targeted action and cross-border collaboration, South Africa has the potential to eliminate malaria by 2020.

¹¹ In addition, Algeria reported six unclassified cases of malaria; it is possible that some of these cases were indigenous.

¹² In early 2014, Comoros rolled out a mass drug administration campaign with dihydroartemisinin-piperaquine (DHA-PPQ) and primaquine.

¹³ Namibia has also declared a national goal of malaria elimination by 2020. Although Namibia has made remarkable progress in reducing its malaria incidence since 2000, the challenge of eliminating the disease, particularly along the country's northern border, may be too high to overcome by 2020.

WESTERN PACIFIC REGION



- **China** is aiming to eliminate malaria by 2020. In 2014, the country reported only 56 indigenous cases of malaria, down from 244 cases in 2012. Transmission continues in several regions, particularly in the border areas of Yunnan. However, the country faces a large number of imported cases of malaria – primarily from sub-Saharan Africa but also from neighbouring Myanmar – which will remain a challenge for years.
- **Malaysia** reported 606 indigenous cases of *P. vivax* and *P. falciparum* malaria in 2014, down from 1092 cases in 2013. Malaria transmission is largely confined to two states of East Malaysia located on the island of Borneo – Sarawak and Sabah – with 19.7% and 24.5% of the population at risk, respectively. Elimination efforts should focus on *P. vivax* and *P. falciparum* malaria. Controlling *P. knowlesi* malaria, which has been increasing in recent years, may require a different approach.
- Following eradication efforts in the 1960s and 1970s, malaria all but disappeared in the **Republic of Korea**; by 1984, the country reported just two indigenous cases. In the 1990s, malaria re-emerged near the Demilitarized Zone and a protracted outbreak of the disease affected, disproportionately, the northern part of the Korean Peninsula. Through wide-scale malaria control activities, the Republic of Korea has reduced its rate of new malaria cases by more than 75% since 2000. In 2014, the country reported 557 cases of disease and is on track to meet its declared goal of eliminating malaria by 2020.

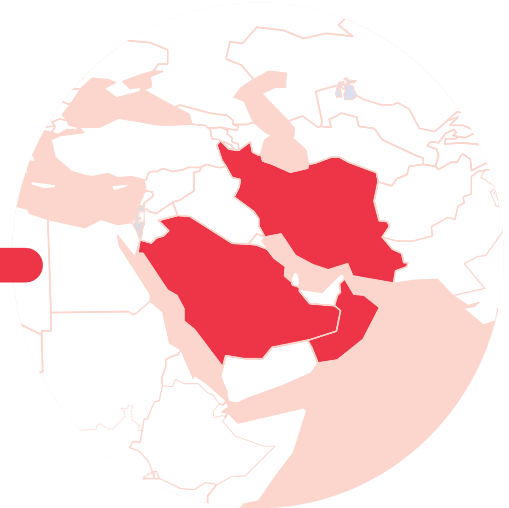
THE REGION OF THE AMERICAS



- Ten countries in Central America and the Caribbean have joined a regional initiative to eliminate malaria by 2020.¹⁴ **Costa Rica** is leading the way: in 2014, the country reported zero indigenous cases of malaria and a small number of imported cases. That same year, **Belize** (19 indigenous cases) and **El Salvador** (six indigenous cases) were well on their way to eliminating malaria. **Mexico** reduced its malaria burden from nearly 7400 confirmed cases in 2000 to 656 cases in 2014.
- In South America, **Argentina** has reported zero indigenous cases of malaria for more than three consecutive years; the country has requested an official certification from WHO of its malaria-free status. In 2014, **Paraguay** reported zero indigenous cases of malaria and a small number of imported cases. **Ecuador** has achieved a steep decline in its malaria burden, from approximately 100 000 cases in 2000 to just 241 cases in 2014. **Suriname** has also reported a sharp drop in malaria cases – from approximately 11 000 cases in the year 2000 to 374 cases in 2014.

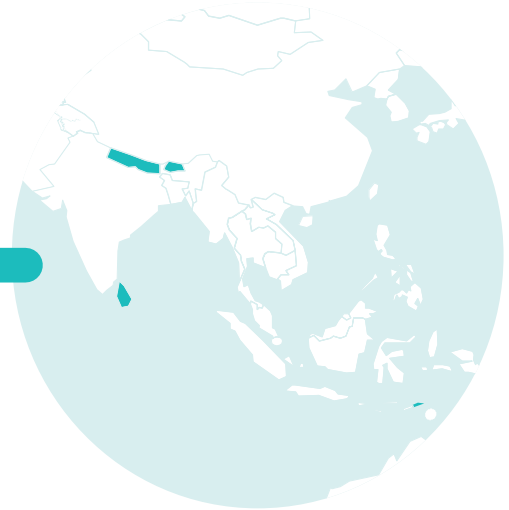
¹⁴ The Dominican Republic has historically had a strong malaria elimination programme; in 2014, the country reported fewer than 500 cases of malaria. Achieving zero cases will likely depend on the success of elimination efforts across the entire island of Hispaniola. Since the beginning of the millennium, Guatemala, Honduras, Nicaragua and Panama have made impressive progress in reducing their malaria cases. In 2014, each of these countries reported fewer than 5000 cases of the disease. However, in all of these countries, ensuring adequate access to malaria prevention and treatment for some at-risk groups remains a key challenge, particularly along the Caribbean coast.

EASTERN MEDITERRANEAN REGION



- In the Eastern Mediterranean Region, **Saudi Arabia** and the **Islamic Republic of Iran** continue to report a downward trend in indigenous malaria cases. Saudi Arabia shares a border with highly endemic areas of Yemen. Through intensive malaria control and cross-border cooperation, Saudi Arabia reduced its locally transmitted malaria cases from a peak of 36 000 in 1998 to just 51 cases in 2014. Iran reported 376 cases of malaria in 2014, down from 21 000 cases in 1998.
- Four countries in the Eastern Mediterranean Region – Egypt, Iraq, Oman and Syrian Arab Republic – eliminated malaria in past years and have since been working to prevent reintroduction of the disease. Since 2007, **Oman** has battled small outbreaks of malaria related to imported cases of the disease; in 2014, the country reported 986 imported cases. That same year, an outbreak of 22 indigenous malaria cases near Aswan, Egypt, was contained using preventive measures.

SOUTH-EAST ASIA REGION



- **Sri Lanka** has achieved remarkable success in reducing its malaria burden from a baseline of more than 200,000 cases in 2000 to zero cases in 2012. No indigenous cases of malaria have been reported in Sri Lanka for the last three years, and the country is now focused on preventing reintroduction of the disease. Among the other South-Asian countries with malaria transmission, **Bhutan** is leading the move toward elimination, with just 19 indigenous cases of malaria reported in 2014 and zero malaria deaths since 2013.
- **Timor-Leste** has achieved a substantial reduction in malaria incidence, with only 342 cases reported in 2014, down from more than 5000 cases in 2012. Currently, 90% of the population lives in areas with ongoing malaria transmission. **Nepal** reported 1469 cases of malaria in 2014, down from 1659 cases two years before. The country has reported zero malaria-related deaths since 2012.

BOX 2.

The challenge of *P. vivax*

For elimination efforts to succeed, greater attention must be given to *P. vivax*, a parasite responsible for nearly half of malaria cases outside of sub-Saharan Africa each year. *P. vivax* presents specific biological challenges that make it harder to diagnose, treat, control and eliminate than *P. falciparum*.

In many areas where *P. vivax* predominates, mosquitoes bite outdoors and early in the evening. As a result, conventional malaria control tools that work well against indoor-feeding and night-biting mosquitoes – such as indoor residual spraying and insecticide-treated nets – may be less effective against *P. vivax*.

P. vivax infections are more difficult to detect as the number of parasites circulating in the blood is typically low. The parasite can remain hidden and dormant in a patient's liver and can cause multiple episodes of malaria months or, even years, later. Treating the dormant stages of the *P. vivax* parasite requires a long treatment regimen which can be associated with side effects.¹⁵

P. vivax is the dominant malaria parasite in many countries that are prime candidates for malaria elimination. Each year, the parasite accounts for more than 70% of malaria cases in countries with fewer than 5000 cases of the disease. In areas where both *P. vivax* and *P. falciparum* coexist, the incidence of *P. vivax* malaria typically decreases less rapidly than that of *P. falciparum*.

In July 2015, WHO published a technical brief on the control and elimination of *Plasmodium vivax*. The brief highlights the need for international donors and governments to invest in additional measures to control, eliminate and prevent re-establishment of *P. vivax*.

¹⁵ Many patients have difficulty complying with the *P. vivax* treatment regimen, which requires a 14-day course of the drug primaquine. Patients who have a severe deficiency of the enzyme glucose-6-phosphate dehydrogenase (G6PD) are susceptible to potentially severe side effects. Pregnant women and children less than 6 months old cannot take this drug.

Preventing re-establishment of malaria

After malaria cases have been reduced to zero in a particular area or country, preventing a resurgence of the disease is a key concern. Malaria imported by visitors and migrants carries the risk of resuming local transmission of the disease in areas where *Anopheles* mosquitoes remain and conditions for transmission are favourable.

Countries that achieve a “malaria-free status” may be reluctant to commit personnel, time and expenditure to a disease that has been eliminated within their borders. It is vital that they retain adequate surveillance systems to detect cases quickly and skilled personnel to diagnose and treat them.

A number of countries that have achieved zero indigenous cases, but have not been certified by WHO as malaria-free, are working to prevent reintroduction of malaria. Countries that have been certified as malaria-free and countries on the WHO supplementary list are also exposed to the threat of re-establishment of malaria and may, from time to time, see local transmission of malaria linked to imported cases of the disease.

BOX 3.

The risk of re-establishment

Two factors determine the risk of re-establishment of malaria: (1) the number of malaria cases imported into a malaria-free area, known as “vulnerability”, and (2) the risk in a malaria-free area of local mosquitoes becoming infected with malaria parasites and subsequently transmitting the infection to humans, known as “receptivity”.

If the vulnerability rate is high, but receptivity is low, there will be little risk of re-establishment of malaria. This is the case in Europe, the United States of America and Canada, where thousands of imported cases of malaria arrive each year but where local mosquitoes only rarely become infected and transmit the infection.

Where both vulnerability and receptivity are high, the risk of re-establishment is also high. That is the case in countries like Sri Lanka and Oman, which have previously had high transmission of malaria and are subject to the arrival of a large number of individuals infected with malaria. In these settings, imported cases must be detected rapidly to prevent onward transmission of malaria to the local community.

WHO certification process

Certification of malaria elimination is the official recognition by WHO of a country’s malaria-free status. It confirms to the international community that the country, at that point in time, has halted local transmission of malaria by *Anopheles* mosquitoes and that it has created an adequate system for preventing the re-establishment of the disease. WHO grants this certification when a country has proven, beyond reasonable doubt, that the chain of local malaria transmission by *Anopheles* mosquitoes has been interrupted nationwide for at least three consecutive years.

The burden of proof falls on the country requesting certification. A national surveillance system capable of rapidly detecting and responding to local malaria transmission (if it were occurring) must be operational, together with an appropriate programme to prevent its re-establishment. The final decision on granting a certification of malaria elimination rests with the WHO Director-General.

Certification of malaria elimination is managed by the WHO Global Malaria Programme and involves field assessments and rounds of expert reviews. This process is voluntary and can be initiated only after a country has submitted an official request to WHO.

OFFICIAL REGISTER OF MALARIA-FREE COUNTRIES

Since the early 1960s, WHO has maintained an official *Register of areas where malaria elimination has been achieved*. In all, 33 countries and territories have been certified and entered in the WHO official register as having eliminated malaria through specific measures. The most recent additions are the United Arab Emirates (2007), Morocco (2010), Turkmenistan (2010) and Armenia (2011).¹⁶ Three countries, recently started this certification process: Argentina, Kyrgyzstan and Sri Lanka.

WHO also maintains a *Supplementary list to the official register*, which includes countries where malaria never existed or disappeared decades ago, and where full WHO certification of malaria elimination is not needed. The most recent *Supplementary list* was published in the *World Malaria Report 2012* and included 62 countries.

¹⁶ The Maldives was certified by WHO as malaria-free in 2015 but has not been added to the WHO official register as of yet.

The way forward

The *Global Technical Strategy for Malaria 2016–2030* provides a framework for all countries working to eliminate malaria, at every point along the elimination continuum. It is founded on five core principles that highlight the need for:

- **Tailored responses:** All countries can accelerate progress towards elimination through an effective mix of interventions and strategies tailored to local contexts. A malaria control strategy that works well in Malaysia, for example, may not be the best approach in Nigeria or Panama.
- **Country ownership and leadership:** For elimination efforts to succeed, government stewardship in malaria-endemic countries is essential, together with the engagement and participation of affected communities. Malaria responses within national borders can be optimized through cross-border collaboration.
- **Strengthened surveillance.** Malaria surveillance is the cornerstone of programme planning; it helps countries identify gaps in coverage of malaria control tools and take action based on the data received. As countries approach elimination, detecting every infection, or clusters of infections, becomes increasingly important to halt any remaining areas of transmission.
- **Equity in access to health services.** As some countries approach elimination, a high proportion of cases are found among vulnerable populations living in remote areas. Progress can be accelerated by ensuring access to malaria prevention and treatment for all at-risk groups, regardless of their legal status.
- **Innovation in malaria control tools.** Eliminating malaria in all countries, especially those with a high disease burden, will likely require new tools that are not available today. Investing in the research and development of improved diagnostics, more effective medicines, new insecticides and innovative vector control tools must be a priority.

By embracing these core principles, malaria-affected countries can accelerate progress towards the 2030 goals of the Global Technical Strategy – including a 90% reduction in case incidence and mortality. Achieving these goals will represent unprecedented progress in the fight against malaria and bring the global community closer than ever before to our common vision of a malaria-free world.

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