



Eliminating malaria in CHINA



China reported 2,921 cases in 2014—98 percent of which were imported—and aims to eliminate malaria by 2020.

Overview

China has made tremendous progress toward malaria elimination in the past two decades, with just 2,921 cases reported in 2014. *Plasmodium vivax* and *P. falciparum* are both major plasmodium species, though *P. vivax* is predominant and accounts for 88 percent of malaria cases^{1,2} Malaria has been eliminated from most of the country; the remaining at-risk areas are in Tibet and Yunnan Province in the south where local transmission still occurs.^{2,3} There were 24 malaria-related deaths in 2014, a 23 percent decrease from the 31 deaths reported in 2000, although most deaths in recent years can be attributed to imported *P. falciparum*.^{1,4}

Due to China's vast size and varying climate, malaria transmission differs throughout the country. The primary vectors are *Anopheles sinensis* and *An. anthropophagus*, found mainly in the central and northern regions and associated with *P. vivax* transmission, and *An. minimus* and *An. dirus*, found mainly in the southern regions and associated with *P. falciparum* transmission. Secondary vectors include *An. maculatus s.l.*, *An. aconitus*, *An. philippinensis*, and *An. harrisoni*.^{5,6} *P. falciparum* is endemic in southern China and has year-round transmission. *P. vivax*, which thrives in more temperate climates, is distributed throughout southern and central China with transmission primarily occurring between May and July.⁵ In southern China, most cases, both local and imported, occur among migrant workers living and traveling through forested border regions between China and neighboring Myanmar, Lao People's Democratic Republic, and Vietnam.³ In other areas of the country, the majority of imported cases occur among workers returning from Africa.²

In light of the substantial decline in malaria incidence, and with financial support from the Global Fund, the national malaria control program (NMCP) in China began implementing a malaria elimination strategy in 2010, with the goal of zero indigenous cases outside of Yunnan province by 2015, and national elimination by 2020.⁷ China receives technical sup-

At a Glance¹

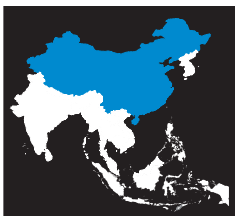
57	Local/unclassified cases of malaria (88% <i>P. vivax</i>)
24	Deaths from malaria
42	% population at risk (total population: 1.4 billion)
0.000004	Annual parasite incidence (cases/1,000 total population/year)
0.001	% slide positivity rate

N/A: not available

port for elimination as a country partner in the Asia Pacific Malaria Elimination Network (APMEN), a network composed of 18 Asia Pacific countries and other stakeholders working to eliminate malaria in the region.⁸ In addition, Yunnan Province is a beneficiary of the United States Government's President's Malaria Initiative (PMI) efforts to halt the spread of artemisinin resistance in the Greater Mekong Subregion.⁹

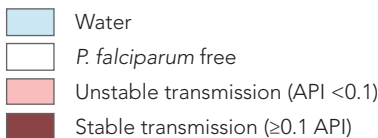
Progress Toward Elimination

Descriptions of malaria in China go back thousands of years. According to available records, epidemics in the 1930s were severe: a 1931 outbreak in Yang-Tse-Kiang valley affected 60 percent of the 28 million population, and in 1933, an epidemic in Yunnan Province killed over 30,000 people.⁵ In the 1940s, at least 30 million malaria cases occurred nationally, with an annual mortality rate of about one percent.¹¹ Prior to launching the NMCP in 1955, it was estimated that malaria was endemic in 70–80 percent of all counties in China. Data from 1954 indicated that there were nearly seven million cases, though the situation was likely far more severe due to underreporting.^{5,11} As a result of the devastating effects of malaria, particularly in rural areas, the NMCP was established

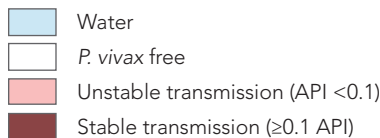
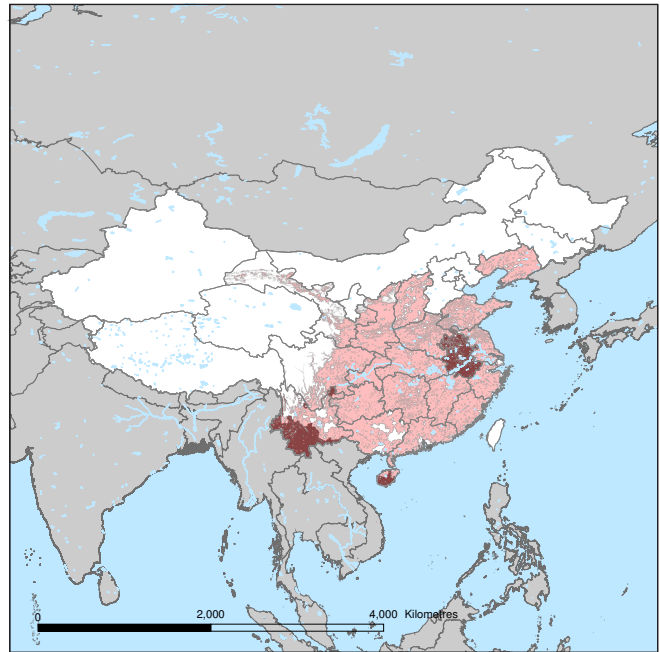


Malaria Transmission Limits

Plasmodium falciparum



Plasmodium vivax



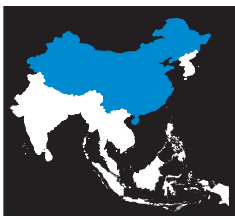
P. falciparum/*P. vivax* malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

at national, regional, and district levels with substantial government funding.¹¹

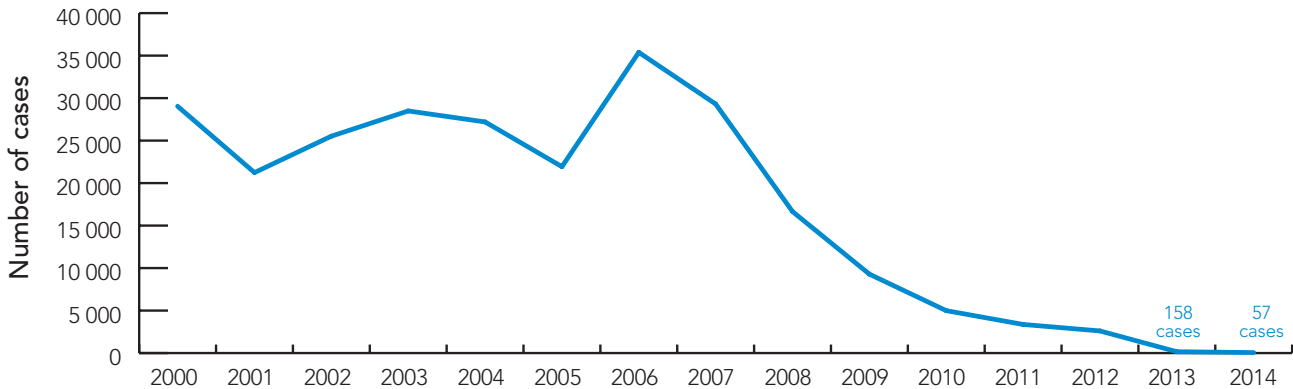
Malaria incidence in 1955 was 10 cases per 1,000 population with more than 5,500 malaria-related deaths. Because the NMCP increased testing and reporting capacity, reported malaria incidence actually increased to 15 cases per 1,000 population by 1960; however, malaria-related deaths decreased to fewer than 400, a 90 percent decline.¹¹ Interventions in the 1950s and 1960s varied according to the differing epidemiological conditions throughout the country, and the NMCP implemented an integrated approach rather than focusing solely on indoor residual spraying (IRS). Prompt treatment, reduction of man-vector contact, and strengthening of personal protection measures were the priorities of

the program, and were applied flexibly according to local conditions.¹² Despite a major *P. vivax* epidemic outside of Beijing in the early 1960s, overall incidence and mortality rate continued to decline over the next decade.^{5,6}

By 1970, the Cultural Revolution had interrupted control operations, and malaria incidence more than tripled to nearly 30 cases per 1,000 population with 239 malaria-related deaths.^{5,11} A 1973 outbreak in central China resulted in 13 million cases, most of which were reported from five provinces: Anhui, Henan, Hubei, Jiangsu, and Shandong. These areas were densely populated which facilitated rapid transmission, and in order to bring the epidemic under control, the NMCP prioritized intersectoral collaboration between the affected provinces for all malaria control activities.¹¹ System-



Reported Malaria Cases*



Strengthened surveillance significantly reduced cases after a series of outbreaks in the early 2000s.

*Graph shows total reported cases from 2000–2012; from 2013 onwards, only local and unclassified cases are shown.

Source: World Health Organization, World Malaria Report 2015; China NMCP

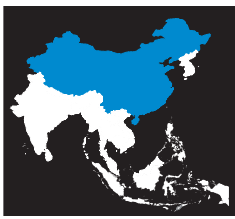
- Goals:**¹⁰
1. Three consecutive years of zero indigenous cases in Type II (low transmission) and most Type I (high transmission) counties (except for border counties of Yunnan) by 2018.
 2. National malaria elimination by 2020.

atic control efforts were reinstated nationwide in 1978, led by provincial anti-epidemic services within the Chinese primary health care system. As a result, between 1980 and 1990, total malaria cases dropped significantly, from more than three million cases to fewer than 120,000. From 1979 to 1998, more than 700,000 health workers were trained in epidemiology, entomology, parasitology, and malaria control interventions, in an effort to achieve coverage of 500 million people. Between 1991 and 1998, 15 million people were treated for malaria, 34 million received prophylactic drugs during transmission seasons, and more than 110 million residents benefited from IRS and insecticide-treated bed nets (ITNs).¹¹ By 2000, no cases were reported in the northern provinces and only 29,039 cases were reported nationally, although underreporting during this period is believed to be likely.^{5,6}

From 2000 to 2006, there was a substantial increase in malaria cases due to reemerging *P. vivax* in central China in the provinces of Anhui, Henan, Hubei, Hunan, and Jiangsu. Malaria incidence in these areas tripled from 0.03 per 1,000

population in 2002 to 0.09 per 1,000 population in 2006.^{6,13} Driven by this outbreak, national cases increased from nearly 30,000 in 2000 to more than 115,000 cases by 2006, after reaching a peak of 172,000 in 2002.¹ Cross-border migration between Myanmar and Yunnan Province, a weak surveillance and reporting system, and potential parasite resistance to chloroquine, among other factors, are believed to have contributed significantly to the epidemic.^{6,14}

In 2002, China received a Round 1 grant from the Global Fund to control malaria in the high-transmission regions of the country, namely Yunnan Province—which borders the Lao People’s Democratic Republic, Myanmar, and Vietnam—and the island of Hainan. Malaria program activities focused on limiting the spread of drug-resistant *P. falciparum* by improving access to diagnosis and treatment for mobile populations through the establishment of mobile clinics.¹⁵ Through a Global Fund Round 5 grant, China was able to roll back the resurgence of *P. vivax* in the central provinces, and strengthen its work in resource-poor areas by distributing



long-lasting insecticide-treated bed nets (LLINs), providing microscopes and training to health workers, and supplying artemisinin-based combination therapies (ACT) for confirmed cases.¹⁴ A Global Fund Round 6 grant continued malaria control work in Yunnan along the border with Myanmar through the establishment of new health posts and strengthening of existing ones, and providing comprehensive malaria trainings to health workers who treated migrants crossing between China and Myanmar.¹⁶ Between 2002 and 2009, reported malaria cases in China declined by 64 percent and malaria-related deaths declined by 76 percent.¹

Building on this success, in 2010, the NMCP was awarded a National Strategy Application grant by the Global Fund to move from control to elimination by: 1) providing access to early, accurate diagnosis and prompt, effective, and safe treatment; 2) ensuring vector control measures for the populations at risk; 3) strengthening malaria health education by mobilizing community participation; 4) distributing ITNs to vulnerable, poor, and marginalized populations; 5) strengthening the national malaria surveillance system; and 6) providing effective program management to implement malaria control and elimination strategies.⁷

Significant progress has been made under the elimination strategic plan, particularly the improvements to the surveillance system. China now utilizes a national, internet-based reporting system called the China Information System for Disease Control and Prevention (CISDCP), and recently rolled out the 1-3-7 system for malaria surveillance, which delineates a set of time-bound actions including case reporting to CISDCP within one day, thorough case investigation within three days, and focal investigation, reactive case detection, and targeted vector control intervention within seven days.^{3,17} In addition, the NMCP has established a network of malaria diagnosis reference laboratories to support accurate case diagnosis and validation, build malaria sample banks, and provide capacity training and technical support for malaria workers at all levels of the health system. Twenty reference laboratories have been established at the national and provincial levels to serve historically endemic areas of the country.¹⁸ Since the onset of elimination strategy implementation in 2010, malaria cases have declined 97 percent, placing the goal of national elimination by 2020 within very close reach.¹

Eligibility for External Funding¹⁹⁻²¹

The Global Fund to Fight AIDS, Tuberculosis and Malaria	No
U.S. Government's President's Malaria Initiative	Yes*
World Bank International Development Association	No

*PMI support for the Greater Mekong Subregion includes Yunnan Province; China is not eligible for national support from PMI.

Economic Indicators²²

GNI per capita (US\$)	\$7,400
Country income classification	Upper middle
Total health expenditure per capita (US\$)	\$367
Total expenditure on health as % of GDP	6
Private health expenditure as % total health expenditure	44

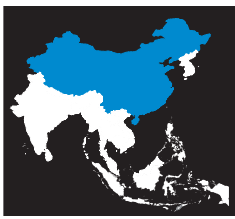
Challenges to Eliminating Malaria

Transmission along the China-Myanmar border

Although many of the countries that border China are malaria-endemic, the malaria situation in Myanmar is severe and China's border province, Yunnan, is its highest-risk region. The areas along China's border with Myanmar are the least developed and the population is comprised of ethnic minority groups who are highly mobile due to their occupations. These groups often live in areas where health services are very difficult to access and they tend to sleep in informal shelters in forests where protection from mosquitoes is minimal.^{13,16} Cross-border collaboration between China and Myanmar to address malaria transmission among these high-risk populations is facilitated through regional initiatives such as the PMI Greater Mekong Subregion project and APMEN, and China has received financial support for border malaria control from the Global Fund.^{8-9,16}

Imported cases from Africa

Outside of the border region with Myanmar, the biggest threat to China's successful achievement of elimination is the ongoing threat of importation from travelers returning from



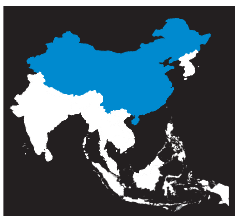
Africa. China has expanded its business investments in Africa in recent years, and an increasing number of Chinese nationals travel to and from countries with endemic *P. falciparum* transmission. Because much of China remains susceptible to transmission and the population in formerly-endemic provinces has low immunity, the risk of outbreaks is quite high. Maintaining rigorous surveillance as outlined in the 1-3-7 strategy will be essential to prevent malaria resurgence.²³

Conclusion

With a national strategic plan for elimination in place, and greatly improved surveillance and diagnostic capabilities, China successfully brought local malaria cases down to just 57 in 2014. Through continued cross-border collaboration with Myanmar and ongoing surveillance to detect imported cases, China is in an excellent position to achieve national elimination in advance of its 2020 goal.

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Transmission Limits Maps Sources

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About This Briefing

This Country Briefing was developed by the UCSF Global Health Group's Malaria Elimination Initiative, in partnership with the Jiangsu Institute of Parasitic Diseases. To send comments or for additional information about this work, please email Anne.Bulchis@ucsf.edu.



The **Global Health Group** at the University of California, San Francisco is an 'action tank' dedicated to translating new approaches into large-scale action that improves the lives of millions of people. Launched in 2007, the UCSF Global Health Group's **Malaria Elimination Initiative (MEI)** works at global, regional, and national levels to accelerate progress toward malaria elimination in countries and regions that are paving the way for global malaria eradication. The MEI believes that global eradication of malaria is possible within a generation.

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The **Malaria Atlas Project (MAP)** provided the malaria transmission maps. MAP is committed to disseminating information on malaria risk, in partnership with malaria endemic countries, to guide malaria control and elimination globally. Find MAP online at: www.map.ox.ac.uk.

