India has reduced malaria incidence and mortality over the past decade and is aiming to eliminate malaria by 2030.

Overview

India achieved a 46 percent decrease in reported malaria cases between 2000 and 2014 and is considered to be in the control phase by the World Health Organization (WHO). In 2014 there were a reported 1.1 million malaria cases and 562 malaria attributed deaths. In India, the malaria burden is exceptionally high in the low-income, rural areas of the northeastern (NE) states. However, endemicity across the subcontinent varies greatly and other important foci exist outside the NE region.

There are six major anopheline vectors present in India. Anopheles culicifacies is widely distributed throughout the country and is the primary vector of rural and peri-urban malaria; An. stephensi is the primary urban vector; An. fluviatilis is present in many of the hills, foothills and forest fringe areas; An. minimus and An. dirus are primarily present in the highly endemic NE region; and An. epiroticus (previously An. sundaicus) is restricted to the Andaman and Nicobar islands. Secondary vectors include: An. annularis, An. varuna, An. jeyporiensis and An. philippinensis.

Malaria in India is primarily caused by Plasmodium falciparum (66 percent) and P. vivax (34 percent). Both species occur together in many areas throughout India. P. falciparum is predominant in the NE region.

Malaria transmission in India is unstable and marked by some seasonality related to the rainy season, which usually occurs between June and September. Due to unstable transmission throughout the country, most of the population lacks protective immunity to malaria. The populations considered to be at higher risk for malaria include shifting cultivators and forest workers, pregnant women, children under five years of age, migrant and mobile populations, and the armed forces.

At a Glance

- 1,102,205 Local cases of malaria (66% P. falciparum)
- 562 Deaths from malaria
- 91% population living in areas of active transmission (total population: 1.25 billion)
- 0.085 Annual parasite incidence (cases/1,000 population at risk/year)
- 0.80% slide positivity rate

The National Vector Borne Disease Control Programme (NVBDCP) is the umbrella program for the prevention and control of vector borne diseases in India, including malaria. This program, jointly implemented by the central government and the states, is considered one of the most comprehensive public health programs in the country. The NVBDCP works with the National Health Mission (formally the National Rural Health Mission) at the primary health care level by scaling malaria diagnosis, prevention, and treatment within an integrated health care system. The NVBDCP also works closely with the National Institute of Malaria Research (NIMR) to conduct operational research.

India is aiming to reach national elimination by 2030. Political support for this goal is strengthened through India’s partnership 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, and the Asia Pacific Leaders Malaria Alliance (APLMA). The APLMA Elimination Roadmap emphasizes regional cooperation and cross-border collaboration to achieve malaria elimination in the Asia Pacific region by 2030.
Malaria Transmission Limits

**Plasmodium falciparum**

- Water
- *P. falciparum* free
- Unstable transmission (API < 0.1)
- Low stable transmission (0.1 ≤ API < 1.0)
- Stable transmission (≥1.0 API)

**Plasmodium vivax**

- Water
- *P. vivax* free
- Unstable transmission (API < 0.1)
- Low stable transmission (0.1 ≤ API < 1.0)
- Stable transmission (≥1.0 API)

*P. falciparum*/*P. vivax* malaria risk is classified into no risk, unstable risk of < 0.1 case per 1,000 population (API), low stable risk of ≥ 0.1 to < 1.0 case per 1,000 population (API), and stable risk of ≥ 1.0 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.

Progress Toward Elimination

India has a long-standing history with malaria. Evidence of malaria on the Indian subcontinent can be found in ancient medical literature and the use of mosquito nets in India is mentioned in Marco Polo’s writings from the 13th century A.D.11 In 1897 in Secunderabad, India, Ronald Ross, a British physician born in India, confirmed the role mosquitos have in the transmission of malaria.12,13 It is estimated that at the time of independence in 1947, there were an estimated 75 million malaria cases and 800,000 malaria-attributed deaths annually.3,6,12 In 1953, the Government of India launched the National Malaria Control Program (NMCP).12 After reducing malaria to 2 million cases within 5 years, India joined the WHO’s Global Malaria Eradication Program (GMEP) in 1958 and renamed the NMCP the National Malaria Eradication Program (NMEP).1 The subsequent widespread use of DDT for vector control and the use of chloroquine (CQ) in treating malaria infections drastically reduced the malaria burden.3,14 By 1964 malaria was eliminated in 88 percent of the country and in 1965 there were less than 100,000 malaria cases and zero recorded deaths.3,15

During the same period, the number of malaria cases in urban areas began increasing as a result of rapid and unplanned urban development, often resulting in slum...
In the 1970s, increasing shortages of DDT compounded by financial, operational, and technical challenges, including drug and insecticide resistance, contributed to a resurgence of malaria. In 1976, 6.45 million cases were recorded. In response, the Modified Plan of Operation (MPO) was launched in 1977 with a primary focus on reducing malaria cases and deaths, marking a shift in strategy from malaria elimination to control. The MPO focused on expanding treatment by opening Drug Distribution Centers (DDCs) and Fever Treatment Depots (FTDs) throughout the country. Additionally, under the MPO, indoor residual spraying (IRS) was recommended for areas with an API of two or more per 1,000 total population per year. However, due to scarce resources, IRS was only implemented in areas with an API of five or more per 1,000 total population per year.

In 1982, the first national drug policy for malaria was drafted. This policy recommended different drug regimens depending on the area’s plasmodium species and CQ resistance status. In 1985, malaria cases dropped to 1.85 million and stabilized at approximately 2 million annual cases for the next 5 years. Meanwhile, increasing resistance to CQ helped fuel the spread of P. falciparum across the country. The PfCP was drafted.

Goals: 1. Eliminate malaria (zero indigenous cases) throughout the entire country by 2030
2. Maintain malaria-free status in areas where malaria transmission has been interrupted and prevent re-introduction of malaria.

The introduction of core malaria interventions has contributed to decreases in malaria cases.

* India does not distinguish between local and imported when reporting case numbers

ultimately terminated in 1988, by then *P. falciparum* accounted for approximately 40 percent all malaria cases in India.\(^{17,20}\) Later in 1995, the drug policy was modified to include sulphalene/sulphadoxine pyrimethamine (SP) in areas with known CQ resistance.\(^{19}\)

In 1995, the Modified Action Plan (MAP) for malaria control was implemented following a number of malaria outbreaks and epidemics across several states.\(^{2,21}\) Under MAP, an expert committee was established to identify and define high risk areas in the country and implement appropriate interventions for future outbreaks and epidemics.\(^{21}\) However, shortly thereafter in 1996, widespread outbreaks throughout the country resulted in more than 3 million malaria cases and over 1,000 malaria-related deaths.\(^{2,3}\) The eradication goal was officially abandoned in 1997.\(^{3}\)

Also in 1997, the World Bank-funded Enhanced Malaria Control Project (EMCP) was initiated in 100 high-burden districts in eight north Indian states.\(^{3,22}\) The major components of the project included: (1) early case detection and treatment, (2) selective vector control, (3) insecticide-treated bed nets (ITNs), (4) epidemic response and inter-sectoral collaboration, and (5) institutional strengthening.\(^{22}\) Success of the project was varied and revealed several operational challenges.\(^{22,23}\) However, the project is credited with improving the quality and completeness of malaria surveillance data and expanding laboratory diagnostic capacity.\(^{24}\) Additionally, malaria morbidity decreased in districts covered by the EMCP project.\(^{24}\)

Soon thereafter in 2002, the national malaria program was integrated into the newly launched NVBDCP.\(^{3}\) This program aims to prevent and control major vector borne diseases including malaria, dengue, and chikungunya, among others, with a particular focus on vulnerable populations and challenging settings.\(^{3,21}\)

The original EMCP ended in 2005, but the World Bank continued to fund malaria control and kala-azar elimination efforts in nine states through 2013.\(^{25}\) India received its first Global Fund grant for malaria, the Intensified Malaria Control Project (IMCP), in 2005.\(^{3}\) The major objectives of the IMCP were to (1) increase access to rapid diagnosis and treatment, (2) reduce risk of malaria transmission by using integrated vector management (IVM), and (3) enhance awareness and promote community engagement. This grant, and the subsequent IMCP-II (2010–2015), focused on the seven NE states which suffer from a high-burden of malaria morbidity and mortality, low socio-economic status, and poor access to health services.\(^{3}\)

Rapid diagnostic tests (RDTs) and artemisinin-based combination therapy (ACT) were recommended for use starting in 2005 and 2006, respectively.\(^{2}\) In 2007, presumptive treatment of malaria was no longer endorsed; all suspected malaria cases in India should now be confirmed by either microscopy or RDTs.\(^{2,19}\) In 2009, the use of artemisinin monotherapy was banned and the free distribution of long-lasting insecticide-treated nets (LLINs) as an intervention in high-risk areas was introduced.\(^{1,27}\)

The Global Fund-supported IMCP-II succeeded in lowering the API by 43 percent and malaria mortality by 61 percent in the seven NE states in 2015 compared to baseline data from 2008.\(^{2}\) This was the result of early diagnosis and complete treatment, IVM, effective monitoring and evaluation (M&E), and health system strengthening efforts.\(^{2}\) The NGO Caritas India and the Department of Economic Affairs in the Ministry of Finance successfully applied for a Global Fund grant in 2015 that will allow their malaria control program to continue in the high-burden NE states and Odisha.\(^{26}\) In the first half of 2016 over 7 million LLINs were distributed among populations residing in malaria high-risk areas (API >1).\(^{2}\) As a result the NVBDCP expects further declines in the malaria burden.\(^{2}\)

In February 2016, the Government of India launched the National Framework for Malaria Elimination 2016–2030 and set a national elimination goal of 2030.\(^{27}\) Considering the wide range in incidence and diverse ecotypes in India, the national malaria control program is applying a stratified approach to malaria elimination activities.\(^{3}\) As per this framework, India aims to achieve zero indigenous cases of malaria by 2027 in a phased manner by stratifying all 36 states and union territories (UTs) into four different categories based on endemicity.\(^{2,10}\) All 26 low and moderate transmission states and UTs (Category 1 and Category 2) will target elimination by 2022; the remaining 10 high transmission states and UTs (Category 3) will target elimination by 2027.\(^{2,10}\) Category 0 states and UTs will aim for prevention of reintroduction after achieving elimination.\(^{2,10}\) The core interventions include ITNs, IRS, early diagnosis and complete treatment, program management, community participation, and M&E.\(^{2}\) This approach is expected to lead to a decrease in malaria incidence in high endemic areas and sustain reductions in low endemic areas.\(^{3}\)
Challenges to Eliminating Malaria

Operational challenges
Many of the areas where malaria exists are dominated by low-income ethnic groups living in rural areas with limited access to health services and are considered hard-to-reach by routine malaria control activities. These operational challenges hinder equitable access to prevention, diagnosis and treatment interventions. Other related operational challenges include shortages of essential supplies and inadequate human resources.

Estimating cases and deaths
There are reports that malaria case data in India is unreliable and that underreporting may be systemic. Independent reports suggest evidence of an incidence gap; malaria cases may be between 9 and 50 times greater than are reported and malaria-related deaths may be 13 times greater than are reported. Several current activities undertaken by the malaria program may help improve case data. For example, increasing training opportunities for health workers, improving confirmed diagnosis, expanding health services, enhancing the role of the community, and incorporating the private health sector, may aid in developing a more robust reporting system. Comprehensive epidemiological data will be an important influence on both long and short-term program success.

Insecticide and drug resistance
Insecticide and drug resistance are serious threats to malaria elimination. In India, widespread *P. falciparum* resistance to CQ has been documented and *P. vivax* resistance to CQ is increasingly reported. Resistance to monotherapies and multidrug therapies, such as CQ and artesunate (AS) + SP, threaten gains. The control of vectors is also a concern in India as insecticide resistance to DDT and pyrethroids exists. For over 3 decades, the Ministry of Health and Family Welfare (MOHFW) has conducted drug resistance monitoring, with support from technical partners like the WHO and NIMR, and will continue to do so. Criteria for a change in drug policy is also documented and dictates that a 10 percent or more treatment failure rate for any antimalarial drug in a designated area necessitates a change in treatment.

Eligibility for External Funding

<table>
<thead>
<tr>
<th>Program/Initiative</th>
<th>Eligibility</th>
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<tbody>
<tr>
<td>The Global Fund to Fight AIDS, Tuberculosis and Malaria</td>
<td>Yes</td>
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<tr>
<td>U.S. Government’s President’s Malaria Initiative</td>
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</tr>
<tr>
<td>World Bank International Development Association</td>
<td>Yes*</td>
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Economic Indicators

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<th>Indicator</th>
<th>Value</th>
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<tr>
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<td>Country income classification</td>
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<td>Total health expenditure per capita (US$)</td>
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<td>Total expenditure on health as % of GDP</td>
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<tr>
<td>Private health expenditure as % total health expenditure</td>
<td>67.8</td>
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</tbody>
</table>

*India graduated from World Bank International Development Assistance at the end of fiscal year 2014 (FY 2014) but will receive transitional support on an exceptional basis through FY17.

Conclusion
Despite these complicated challenges, India remains committed to eliminating malaria and is part of several international coalitions, including the APLMA and APMEN, both of which support the 2030 Asia Pacific malaria elimination goal. By continuing to intensify efforts in high-burden regions while maintaining appropriate inputs in low-burden areas, India will contribute to decreasing the malaria burden in the Asia Pacific region.
Sources

Eliminating malaria in INDIA

Transmission Limits Maps Sources


About This Briefing

This Country Briefing was developed by the UCSF Global Health Group’s Malaria Elimination Initiative, in partnership with the National Vector Borne Disease Control Programme, Ministry of Health & Family Welfare, India. To send comments or for additional information about this work, please email Kelly.Harvard@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. shrinkingthemalariamap.org

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.

APMEN

*asia pacific malaria elimination network*